

# The Mining Journal

LONDON, DECEMBER 14, 1956

Vol. 247. No. 6330

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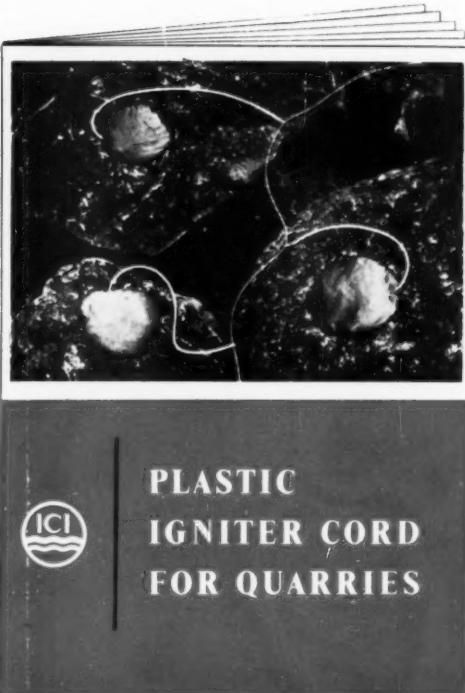
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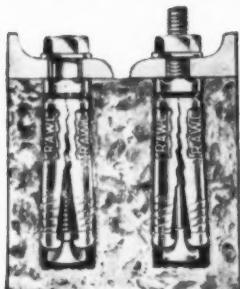
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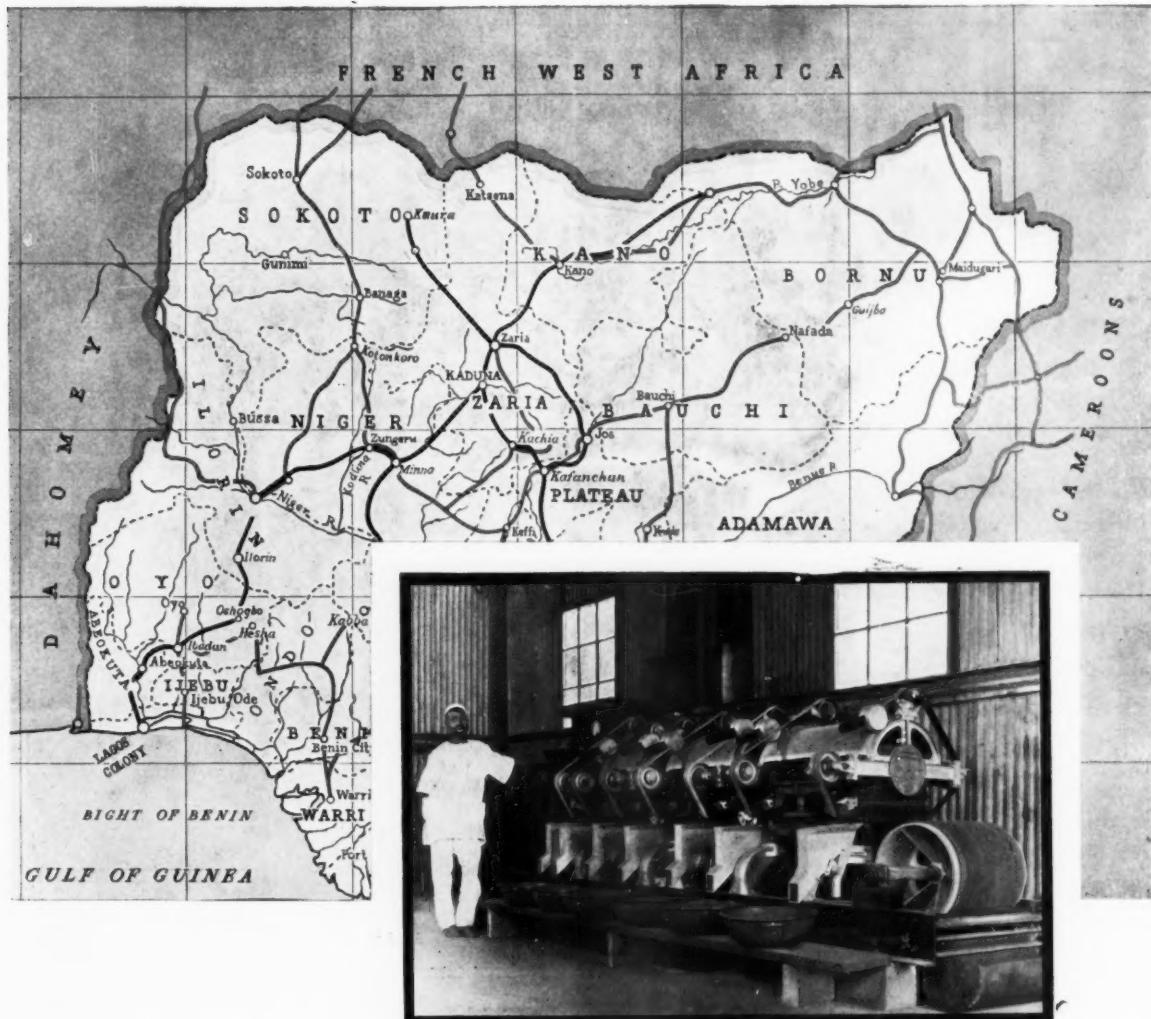
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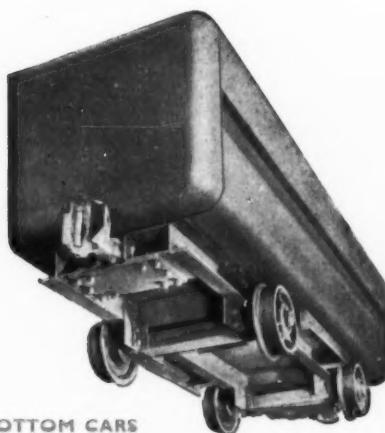


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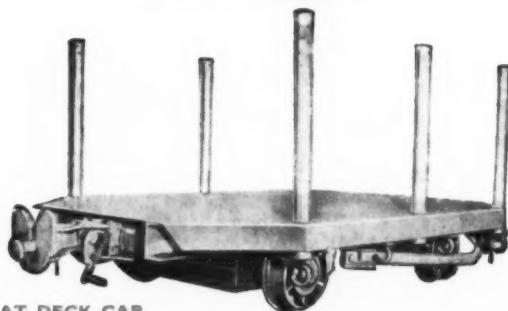
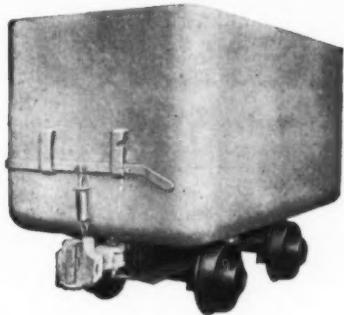
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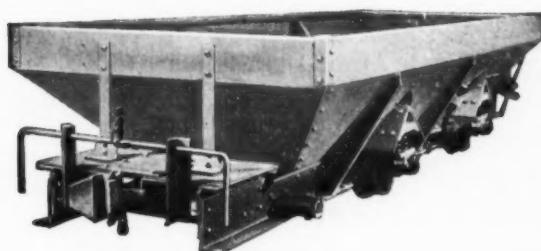
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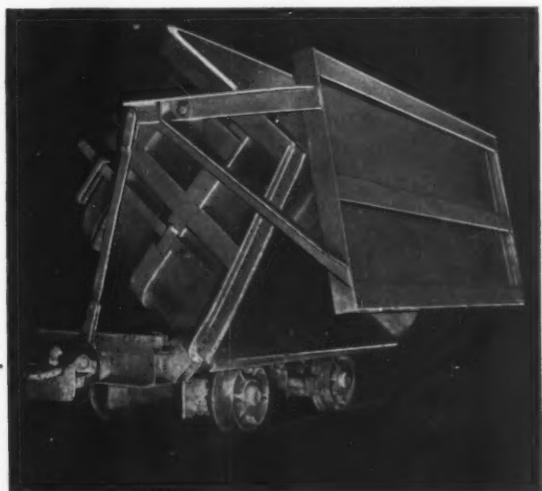
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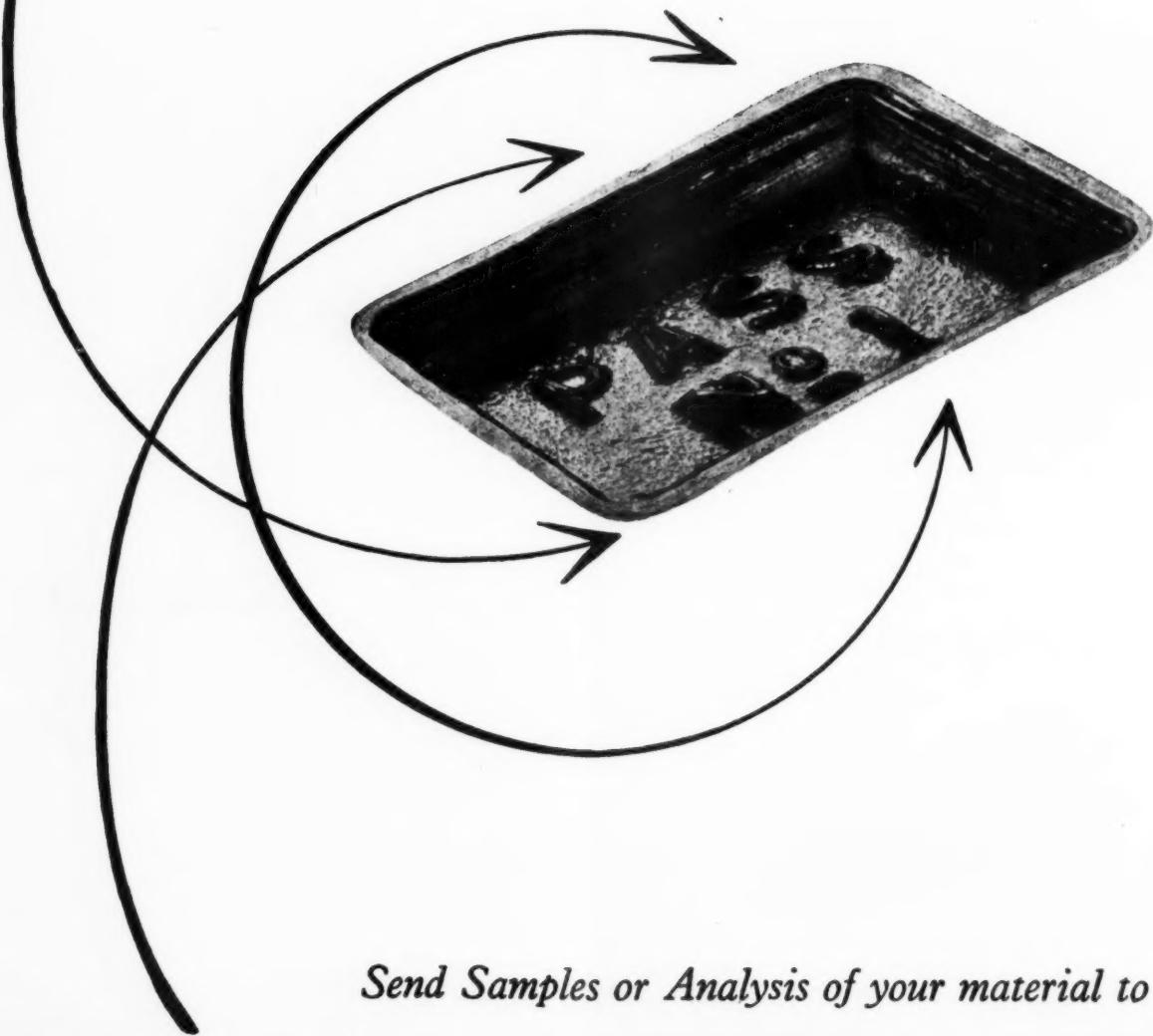
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# The Mining Journal

London, December 14, 1956

### *In this issue . . .*

Is Mechanization the Key to South Africa's Labour Shortage ?	721
Tin—Too Little or Too Much ?	722
Metal Mining's Call to Youth	723
The Possibilities of Full Mechanization in South African Mines	724
Pressure Flameproofed Timber	726
Block Caving in Montana	727
Minerals Research in Australia	728
Machinery and Equipment	729
Mining Miscellany	731
Metals and Minerals	733
London Metal and Ore Prices	735
Mining Finance	736
Financial News and Results in Brief	738
Company Meetings	739

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## **Is Mechanization the Key to South Africa's Labour Shortage?**

**R**EADERS of these columns are already familiar enough with the perennial debate on whether there is a labour shortage (black or white, or both) in South Africa's gold mines, and if so how acute and of how long a probable duration. On this issue (discussed at length in the *M.J.* of February 24 and March 2), it may be recalled that in our view the indications pointing to a bottleneck in the availability both of European and native labour over the next five years or so were strong even assuming no exacerbating factor such as an increase in the gold price. We did, however, also suggest that the bottleneck could and conceivably might be averted, or at least minimized, by a rapid increase in labour efficiencies as a result of better training methods and management, and also (on mines which still have a long life ahead of them) as a result of much-increased output per man shift from increased mechanization—even allowing for the exceptionally selective character of gold mining.

In support of this view, we cited at the time some remarkable figures which had been achieved on the Rand from experimental work in breaking tonnages per shift at the stope face far in excess of the best figures now usually achieved under normal production conditions. Striking confirmation of the potential economies to be effected in labour requirements through increased mechanization and the introduction of automatic or semi-automatic machinery (this latter more particularly on the metallurgical side) has now reached us in the text of a paper presented recently before the South African Institute of Personnel Management by Mr. R. A. L. Black, Professor of Mining at University of the Witwatersrand, and Mr. Tom Edwards, who is also on the staff of the Mining Department.

The chief impression left by this paper, extracts of which are appearing in this and a subsequent issue (see page 724), is that a position could eventually be reached where the gold industry's labour requirements would be very considerably less than they are at present even without making any allowance for the closing of old mines. This applies to the requirements both of European and native labour although it seems safe to assume that the ratio of European to native labour would rise due to the greater need for the pre-planning and close supervision of work.

It should not however be assumed that increased mechanization will mean large-scale substitution of European labour on work at present done by natives. Indeed, the general experience of other industries has been that the more you standardize and mechanize the productive process the greater are the number of elements in the work which can be passed from skilled to semi-skilled labour. Some new thinking will, however, be necessary on the at one time widely held view that there is a definite limit to the benefits from increased mechanization on South African mines, due to the inefficiency of native labour in handling complex machinery. Experience over many years in the Congo, and more recently in South West Africa (which will probably in due course be repeated on the Copperbelt) is contrary to this view and emphasizes that

given correct methods of selection, training and supervision, the African native is a reliable machine minder, and indeed can also be entrusted with quite a lot of maintenance work. In practice, the real barrier to mechanization is more likely to turn out to be the resistance from the European unions. This will doubtless continue long after it becomes apparent that the labour requirements to make possible the growing industrialization of the Sub-Continent can only be met by increased mechanization as well as by increased individual efficiencies and by upgrading the native to categories of work from which he has hitherto been excluded.

Another lesson which by inference emerges very clearly from the Black-Edwards paper is the tremendous scope which is opening up in hard rock mining for the British mining machinery manufacturer. Just as coal mining has learned much in recent years from the metalliferous industry so it is obvious that much of the machinery likely to be used in the mechanized mine of the future will have been conceived in principle, if not in detail, in the coal mine and there is obviously a substantial market awaiting the British coal mining machinery manufacturer who is ready to adapt his specialized engineering know-how to the different circumstances of the hard rock miner. Similarly, it has now become apparent that in gold mining, in common with all branches of metal mining, the necessity of working ever larger tonnages of ores of progressively lower grade is rapidly turning the task of the extraction metallurgist into one of developing the kind of continuous semi-automatic processes which offer tremendous scope for the development by the chemical engineering industry of process plant and machinery of a type which even a decade ago was largely outside the practical thinking of most mine managements.

The American counterparts of our mining machinery and chemical plant manufacturers have already for some years been going through the mental readjustments implied by these developments, and they will doubtless be only too ready to oblige the mining industry in South Africa (or anywhere else in the Commonwealth) if the British manufacturer does not hasten to seize his opportunity. It is becoming increasingly apparent that the requirements of the National Coal Board as well as those of the numerous domestic industries competing with mining for chemical process plant are of such a long term nature that this virtually new export market suggested by the Black-Edwards paper will only be secured by those manufacturers who are prepared deliberately to plan now for productive capacity well in excess of domestic requirements and who then have the determination to earmark this capacity for a new market which has yet to be secured.

#### TIN—TOO LITTLE OR TOO MUCH?

In discussing the world tin situation in his statement to Sungei Besi shareholders, Mr. Simms has some very scathing things to say about the International Tin Agreement. Malayan producers are now being called on to find about £53 a ton of tin concentrates to finance the buffer stock and this at a time when they could very well use the money to find new tin areas and equip them with dredges. He is strongly impressed with the number of dredges that are working themselves out of reserves—and he quotes the chairman of Southern Kinta Consolidated, a company which in five years will have seven out of nine dredges working out their present reserves. He is also impressed

with the present output trends in both Bolivia and Indonesia which he is convinced will produce less tin than formerly. In connection with Bolivian production he quotes the report of Ford, Bacon and Davis, made for the Bolivian government, that in the next five years tin output will decrease by 11 per cent.

To some extent these findings are reinforced by the recently released report of the congress of the heads of mining enterprises in Bolivia. The congress finds, however, that comparing the first nine months of 1956 with the whole of 1955 the rate of tin output declined by only 1 per cent in spite of labour difficulties. The report also suggests that output could be "augmented quite considerably" if there were new equipment, better roads, better transport facilities, and also electric power supplies. While admitting the critical situation in the Bolivian mines, the congress clearly does not believe, or at any rate will not admit, that the position is as bad as Ford, Bacon and Davis suggests.

It is interesting to read in Mr. Simms' statement that he finds world tin output and consumption were in balance at the mid-year period whereas most people have taken the view that there was still a genuine surplus which was, however, being more than absorbed by the Texas smelter. Mr. Simms makes his point by making an adjustment to the world consumption rate to take account of the tin that was not used because of the American steel strike. He estimates that if there had been no strike, world consumption would have been 161,000 tons against world output of 162,000 tons.

Now whether one accepts this calculation and whether one accepts Mr. Simms' view on tin control schemes as a whole, there can be no gainsaying the fact that the tin agreement has come much too late to do very much good and possibly early enough to do some positive harm. The working party was set up to draft a tin agreement as long ago as 1948 when the world tin situation was very different from now. Tin producers are now being asked to find money to finance a buffer stock which, by the rules as at present existing, it may conceivably never be empowered to acquire. However, one cannot be quite sure. A check to industrial expansion, continuation of unrest in the Middle East, the discovery of the true extent of the world surplus (if any) after Texas is closed—all these are factors which might bring tin to within the price range where the tin agreement could usefully work. But even if this argument is used it has to be conceded that the size of any world surplus is not now so overwhelming as to make restriction imperative. Moreover, by all the current economic pointers, consumption should have outstripped output well before the minimum life of the agreement. Nevertheless, having saddled itself with the Tin Agreement, it is not easy for the industry to follow Mr. Simms' forthright advice that "it is time that this International Tin Agreement was scrapped".

The last thing that can be expected of the International Tin Council (which met in London this week) is comment on such heretical views! Its statistical estimate, however, is different and, possible, more plausible. In any case, Mr. Simms struck his balance before the Board of Trade decided to throw 2,000 tons of metal on the market. The Council estimates that there will be a small deficit in 1956 and a small surplus in 1957. Commercial stocks of tin metal have now fallen to an estimated 42,500 tons. The Council has been assured that, in effecting the proposed future disposal of some tin from U.K. non-commercial stocks, the government will take all possible precautions to protect producers and consumers. In any case, having regard to the terms of the tin agreement, such disposals could not commence earlier than the middle of 1957.

The floor and ceiling prices current in the agreement

were discussed by the Council this week. It was agreed that further study was necessary and that the discussions should be resumed at the next meeting. One of the reasons for not allowing any changes of tranches is that the rate of payments by producing countries would vary. Thus to raise, for example, the floor of £640 now would favour those countries which have already paid contributions at that figure. By the time of the March meeting all producers will have paid their quotas to the initial 15,000 tons. As was expected, all contributions made so far have been in cash.

## METAL MINING'S CALL TO YOUTH

In Britain, as in other Western countries, it is now widely realized that in this era of scientific and technological progress, economic and even political survival has become critically dependent on an adequate flow of trained manpower into engineering and industry. The battles of the future will be won not only on the playing fields of Eton but also (and perhaps primarily) in the workshops and laboratories of universities and technical colleges.

Already the demand for scientists and technologists has so far outstripped supply that all industries are suffering from a shortage of graduates. A survey, conducted recently by the British Overseas Mining Association, together with the Institution of Mining and Metallurgy, revealed that the present intake of young men offering themselves for professional training as mining engineers is falling short of future requirements. This situation is particularly alarming in such a basic industry as metal mining, since metals and minerals are the starting materials from which the vast majority of manufactured products are derived. The mining engineer is being called upon to extract metals economically and in ever-increasing quantities from low-grade ores, situated in remote and inaccessible regions or at great depths, and to overcome the problems involved the highest standards of professional skill and knowledge are required. It is thus evident that if the expansion of metal mining is restricted by shortage of graduates, the effects will be felt throughout the manufacturing industries.

Unfortunately, the metal mining industry, despite its key position, has no prior claim on the nation's youth, but must compete with other industries to attract recruits of the right calibre and encourage them to qualify themselves as metal-mining engineers, extraction metallurgists and geologists. Recruitment is handicapped by the tendency in Britain, even among the better informed people, to think of mining in terms of coal, since little but coal is mined in this country to-day, whereas in the British overseas mining industry the emphasis is on metalliferous mining.

Membership of the British Overseas Mining Association includes over a hundred companies, whose activities are by no means confined to the Commonwealth. These look to the United Kingdom as the traditional and still the prime source of mining graduates. In its great task of ensuring that the production of minerals keeps pace with the growth of industrial demand, the British overseas mining industry will be fully extended for many years to come. It is imperative that the flow of technologists should be increased sufficiently to meet all future needs. Indeed, it is useless to press for a mineral resources policy for the Commonwealth, and for tax relief to implement it, if the absence of technical manpower prevents us from stepping up existing activities to any appreciable extent.

The problem is one which, particularly in the present climate of government policy, has to be solved primarily

by the industry itself. Obviously the first step is to go out into the highways and byways—in this case, the public and grammar schools—and sell metal mining to the boys as a well paid career offering interesting and useful work together with reasonable security—seasoned with a spice of adventure, prospects of speedy advancement, and opportunities of seeing the world.

As a major step in what is essentially a selling campaign, we welcome the appearance of B.O.M.A.'s new publication, "Careers in Metal Mining". Attractively illustrated with photographs of mining, prospecting and dredging operations, this booklet depicts the wide scope of the overseas mining industry, reviews the principal functions of the mining engineer, and gives a brief indication of remuneration, living conditions and prospects. It can scarcely fail to interest those young men who, as Shakespeare might have said, are the stuff of which mining engineers are made. Its publication, however, is only the first shot in a campaign which cannot be regarded as ended until trained manpower requirements have been adequately safeguarded for many years ahead.

The next step is to ensure that the booklet reaches—and continues to reach—the largest possible number of potential recruits, together with those in a position to influence them. In this connection, it is apparent that one of the first objectives must be to gain the willing co-operation of the headmaster, since a sympathetic headmaster can be invaluable not only in seeing that the booklets are brought to the notice of boys who might be interested, as part of the present national drive for technologists, but also in answering questions and possibly arranging lectures and other forms of follow-ups. Fortunately, the industry need not necessarily seek out and contact all headmasters individually, since opportunities exist for the industry to meet many of them collectively through their national and regional organizations. Doubtless B.O.M.A. is already exploring ways and means of impressing upon headmasters collectively—and through them careers masters and sixth-form science masters—that few careers are more rewarding and more useful than those offered by metal mining overseas.

Having thus gained an entry, under the right auspices, into as many schools as possible, it still remains to follow up the openings so created by establishing direct contact with the boys wherever any interest is reported. These personal contacts and visits should preferably be undertaken by youngish men holding responsible positions in mines, whose own enthusiasm can do much to kindle the imagination of youth. Ideal ambassadors for the industry are to be found among mine managers and engineers visiting Britain on leave or on business. We suggest that, if approached by B.O.M.A., the companies concerned might make it easier for them to spare the necessary time by extending their periods of leave.

Another fertile field for recruitment is to be found among young men who are terminating their period of military service. Means should be sought for tapping the stream of national service leavers at all possible points, again with the approval and active co-operation of the authorities concerned.

We are confident that Britain still breeds enough young men of adventurous spirit to provide metal mining with an abundance of trained manpower for future requirements and that many of them are capable of rising to the highest technical or administrative positions in the industry. The problem, once personal contact has been made, is to convince them that the opportunities presented by careers in metal mining overseas are fully comparable, in all respects, with those to be found in any other branch of mining, or, for that matter, in any other fields of industry or engineering.

# The Possibilities of Full Mechanization in South African Mines

**I**N talking of mechanization and automation, one is not necessarily thinking only in terms of the mass-production factory, for the principles of the factory can be applied to a wide range of varied activities. In considering how they can be and are being applied to mining conditions and the ancillary operations which accompany mining, we shall base the argument on the assumption that we are to deal with conditions as they are typically found in the gold mining industry in South Africa. It will be convenient to discuss mechanization and automation in relation to the individual departments and activities which together go to make up a mine.

First let us take the administrative departments. Approximately 10 per cent of the European payroll of a typical mine are employed directly on clerical work, mainly in the time offices, and in the stores, statistical and accounting departments; and the great majority of them are engaged on purely routine clerical and book-keeping procedures. Many of these procedures have in recent years been mechanized, but the process of mechanization is still very far from complete. Procedures are usually standard throughout the mines of a group and a great deal of the

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In this and a subsequent issue we are publishing extracts from a notable paper entitled, *The Possibilities of Full Mechanization and Automation in Mining*, which was recently read before the South African Institute of Personnel Management. The authors are respectively Professor of Mining at University of the Witwatersrand and a member of the staff of that department. The implications of this paper are discussed elsewhere in our leading note.

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**By R. A. L. BLACK  
and  
TOM EDWARDS**

work could be handled centrally by specialized automatic computing machines of the type of Leo (Lyons Electronic Office) or Hec (Hollerith Electronic Computer).

Machines of this type would have to be specially constructed to handle the particular clerical problems involved but even at a cost of £20,000 to £30,000 each they would certainly pay for themselves very quickly if they were set up to handle the routine administration of a group of gold mines, a group in this sense meaning four or five mines in the same geographical area. In addition the computers could be designed to process raw statistical data from sampling and deliver estimates of value and grade on a sounder and more comprehensive basis than is possible by conventional means of computation. This also applies to the other numerous operating statistics and costs which are required for the day-to-day control of mining operations.

The full mechanization of administrative procedures, using specially designed electronic computers offers, then, two attractions: the possibility of a considerable saving of labour and the provision to management of control information in a greatly improved form.

Metallurgical processes are ideally suited to mechanized, continuous-flow methods. Indeed, the principles of the mass-production factory were in operation in metallurgical plants long ago. Developments in recent years in the newer plants have all been in the direction of increased mechanization and simplification; but the final stages of gold production, for instance, are still effected largely by hand-operated batch methods. It seems that with time all batch methods are likely to yield to continuous processes, with a consequent reduction in labour requirements. Continuous processes have the added attraction in the final

stages of the recovery of any valuable product that they are inherently safer from a security point of view.

The principal operations performed by the shiftsmen in a hydro-metallurgical plant are the control of feed to the various component machines, chemical control, the opening and closing of valves to direct flow to different parts of the plant, switching in and out items of plant as necessary, and taking samples for assay and chemical analysis for record and control purposes. Hydraulic or pneumatic systems, combined with electronic apparatus, now make it possible to perform all these operations from a central control room; many of the operations can probably be more efficiently performed automatically than they can manually.

An example from the recently commissioned uranium plants is the automatic control of ion-exchange columns by a geiger counter measuring the level of radioactivity in the column. This type of control has a wide application in all types of hydro-metallurgical plant.

It is not too fanciful to envisage big reduction plants of the future operated by two or three shiftsmen at the most from central control rooms, with the assistance perhaps of wired television to enable them to watch key points in the plant more or less continuously.

The stoping operations of a producing mine absorb by far the greatest proportion of the labour force. So far it is the phase in which there has been the least mechanization. The African labourer, armed with a shovel, is still the basic unit of production, although power-operated scrapers are now widely used on most mines to assist the manual effort. The problems to be solved before more extensive mechanization can be applied to stoping conditions are numerous but there are already indications that they can be overcome even in the usually difficult conditions of South African gold mining.

First, suitable equipment would be very expensive, which means that mechanization can only pay if production can be increased and the labour force drastically reduced by the use of machines. This in turn means that a stope must be made to produce a very large daily tonnage before it is economical to equip it with expensive mechanical equipment. Recent experiments have shown that it is possible to break the rock in Witwatersrand conditions on the necessary scale. Quoting from a recent paper by Lambooy and Oxland "This technique . . . resulted in a regular face advance of 3 ft. per blast and was maintained for 14 consecutive shifts when the experiment had to be abandoned

as a result of the inability to clear the stope of accumulated rock and provide the necessary hanging-wall support".

The results achieved in this experiment are an indication of the trend for the future; the daily tonnage broken in the stope was of the order of 150 tons of ore on a face 150 ft. long, roughly three times the tonnage which could have been broken by conventional means. There is no reason why further improvements in the techniques applied in this experiment should not result in the breaking of 300 tons a day in a similar working place.

Now a mine milling 100,000 tons a month could derive the bulk of its tonnage from 12 production units of this type, and if they were to be operated on three shifts, it would require only four sets of equipment working continuously to produce the total tonnage from stoping for the mine. The resultant saving in labour would be enormous, and it is not unreasonable to speculate that a new mine could save the money which this equipment might cost on reduced programmes for European and African accommodation alone.

#### Removing Broken Rock

The problem then is not to break the rock, even with the available techniques of drilling and blasting, we now know that that is possible: the problem is to move the rock once it is broken and to support the resulting rapidly advancing excavation. It is quite clear that conventional scraper units feeding the type of haulage systems in use in metal mines at the present time are not suitable for handling rock on this scale. Nor is the hand-built timber matpack, supplemented by hand-placed waste fill, a suitable means of supporting an excavation advancing at 6 ft. a shift. However, the coal miners, working, admittedly, usually in much easier conditions with a relatively soft ore, have already indicated lines along which the metal miners can explore.

Continuous miners, gathering-arm loaders and coal ploughs, with outputs of the order of 5 to 10 tons a min. when combined with rubber-tyred shuttle cars, belt and scraper conveyors, and recently with extending conveyors that can be wound out while in use like a fireman's ladder, are commonplace equipment in mechanized collieries. Coal mining machines may not be suitable in their present form for handling hard, abrasive rock; but there is basically no reason why modified or new equipment, designed with the experience which has been gained in mechanized coal mining, should not be developed to meet the more strenuous requirements of metal mining.

Again, in the support of the hanging-wall the metal miner has much to learn from coal-mining practice. Mechanization of the type we have been discussing is only possible on a prop-free face, as it is called. Hydraulic props and chocks of the self-advancing type would seem to have application, anyway at shallower depths, and experiments are at present in progress in at least one gold mine with face support of this type. Power stowing of waste rock for permanent support of stoping excavations and for building walls to control the flow of ventilation, will certainly be tried out before long and if it is successful, which it almost certainly will be, it will eliminate one of the most arduous and labour consuming of all mining operations.

There is a coal mine in southern Illinois in the U.S.A. which last year was producing 8,000 tons of coal a day with a total labour force, surface and underground, including the manager, of 215 men. A reef mine with that output would require at the present time approximately 10,000 men. Although the conditions are in no way comparable, the difference in the size of the labour force, 10,000 over

215, is striking, to say the least of it.

Nevertheless, there would seem to be little scope for true automation in stoping operations, since the conditions under which the machines must operate vary continuously; but there is certainly scope in many mines, particularly those mining the wider reefs in relatively easy conditions, for mechanization on a far more comprehensive scale than has yet been attempted.

The changes in the last ten years in mining practice in shaft-sinking and development have been very great and these operations have now reached a very high degree of mechanization. Advances in tunnels of nearly 2,000 ft. a month have been achieved, and the rate of shaft-sinking is steadily approaching 1,000 ft. a month. There would appear on the face of it to be little scope remaining for further mechanization.

However, there is one development in this field which is worth noting since it involves a radical departure from conventional tunnelling practice. The Robbins tunnel borer was developed in the U.S.A. to drive a 25 ft. 9 in. dia. circular diversion tunnel for the Oahe Dam project in South Dakota. This machine was operated and controlled by one man, throwing out the spoil from the face of the tunnel behind it and delivering it by means of a built-in conveyor belt to the haulage system behind. The machine was able to advance this huge tunnel at the rate of 12 ft. an hr., and it consumed electric power at the rate of only 200 h.p. in so doing. This particular machine was designed to operate in the relatively soft shale through which the tunnel passed, but the designers claim that with modifications the machine could operate effectively in granite or quartz rocks. Whether their claims will be justified remains to be seen. If they are, a new era will be opened up for the hard rock miner, both in sinking shafts and in developing, since the principle could be adapted for either purpose. It would of course cut tunnels with a perfect, smooth cylindrical bore and this would have technically great advantages; the smooth cylindrical shape is inherently very strong and it provides ideal conditions for ventilation. Explosives which normally shatter the ground immediately around a mining excavation, would not be used to break the rock, and the smooth bore left by the machine would probably result in no support at all being necessary in the shaft or tunnel; all that would be required would be a sprayed paint or plastic coating to seal the rock surface and prevent weathering.

#### Problems Arising From Concentrated Mining

The trend in recent years has been towards what is generally called concentrated mining, breaking large tonnages in small areas of the mine. This process of concentration, as we have shown, is likely to continue, and may result ultimately in most of the output of a large mine being won in four or five working places each producing about 1,000 tons per 24 hours. This in itself is a problem which will call for a high degree of mechanization in the haulages, either powerful locomotives and big cars or quite possibly conveyor belts. Conveyor belts have the advantage that they can be made to operate automatically; when there is rock for them to convey they start up and when there is no rock they stop.

Another revolutionary idea, which may have application to metal mines that pump large quantities of water to surface, also comes from coal-mining practice. An experimental hydraulic lift system was recently put into commission at Woodend Colliery in Britain in which the coal in suspension in water is pumped to surface via a 7 in. column. This is only a baby plant, but babies grow, and in the U.S.A. a scheme is well advanced for the hydraulic transport of 8,000 tons a day on surface for a dist-

ance of 115 miles.

In South Africa it is now standard practice to deliver mixed concrete to the bottom of vertical sinking shafts via pipe columns; so that we are not without experience of the problems involved in hydraulic transport. The reverse process of delivering rock to surface would considerably ease hoisting problems. If the fines were separated from the coarse rock (a simple process which in any case has to be done when the ore reaches surface), the fine fraction, about 40 per cent of the total tonnage, could be pumped up along with the mine water and delivered straight to the reduction works. The economics of hydraulic transport are very encouraging, and already in South Africa slimes are being pumped considerable distances from one mine to another for uranium extraction.

In conventional hoisting the Koepe system is gaining popularity in metal mining. The system has been in extensive use on the Continent for many years, but has not been generally adopted elsewhere. There is a Swedish mine, where the hoists are set in motion to hoist ore and continue to do so, filling the skips from the measuring flasks at the bottom of the shaft, and refilling the measuring flasks from the ore pass, all automatically, until there is no ore left in the ore pass.

#### Ancillary Services

Although from the cost point of view and as consumers of labour the ancillary and service departments are individually not very important, collectively (leaving out administrative service) they are responsible for approximately 20 per cent of the cost per ton milled and employ about 20 per cent of the total labour force, including a high proportion of Europeans.

For instance, pumping water to surface in some mines is almost an industry by itself, the weight of water pumped to surface equalling ten or twelve times the weight of ore hoisted. There are three main operations in pumping: the chemical treatment of the water, the settling out of solids into a mud-sludge and the separate pumping of the clear water and of the mud-sludge. The chemical treatment, that is dosing the water with predetermined amounts of lime and other chemicals, can certainly be done mechanically, and to a fair extent already is, but continuous automatic control, particularly of the acidity of the water, would be simple to install and, in addition to saving labour, would offer various technical advantages and probably result in a considerable saving in chemicals. The operations of water settlement and pumping are very closely connected, and in many mines in Europe and America they are largely automatic. Limit switches, operated by floats in the settlers and sumps, direct and divert the flow as necessary and operate the pumps.

Ventilation doors in haulages can be made to open and close automatically in response to the flow of traffic by photo-electric cells or other means.

The well-known close relationship between the distribution of gold and uranium values can possibly be used to sample gold content indirectly with a geiger counter, even in areas where uranium itself is not present in economic quantities. If this technique can be developed it may to a large extent eliminate time-consuming, hand-sampling and assaying.

Aerial photography is already making valuable savings in time and labour in topographical surveying. Recently in South Africa the telecommunications division of the C.S.I.R. has developed an electronic range finder which will measure a distance of 20 miles with an accuracy of  $\pm 1$  in. These developments will find their applications to mine surveying in due course.

## Pressure

### Flameproofed

### Timber

**T**HE use and performance of flame retardant timber are depicted in a 16 mm. sound/colour film entitled "Cease Fire," produced by Hickson's Timber Impregnation Co. (G.B.) Ltd. When timber ceased to be a scarce commodity, this company was asked to carry out experimental work on flameproofing of various products. Progress has been so rapid that flameproofed timber, which a few years ago was a rarity, is to-day becoming commonplace. This is due in part to the improved availability of treatment facilities and partly to lower costs.

Among the principal users of "Pyrolith" treated timber is the National Coal Board, which is installing it in a number of new plants, particularly in the East Midlands region, but also in practically all other regions. The new Mines Act, which comes into force in January, 1957, requires mine managers to make section roadways safe for escape and flame retardant timber will be extensively used for this purpose. Other mining applications depicted in the film ranged from sleepers to shaft timbers and the walkways flanking a conveyor feeding a coal preparation plant. Flame-proofed timber is also being used in metalliferous mining in South Africa, Australia and elsewhere.

By comparing the actual performance of treated and untreated timber, the film showed how "Pyrolith" treated timber contributes to safety by increasing the ignition temperature, thus reducing the possibility of timber being involved in a fire, by reducing the rate of flame, thus limiting the extent of the fire in a given time and reducing the chances of other materials being involved; and finally, by charring without a significant temperature rise.

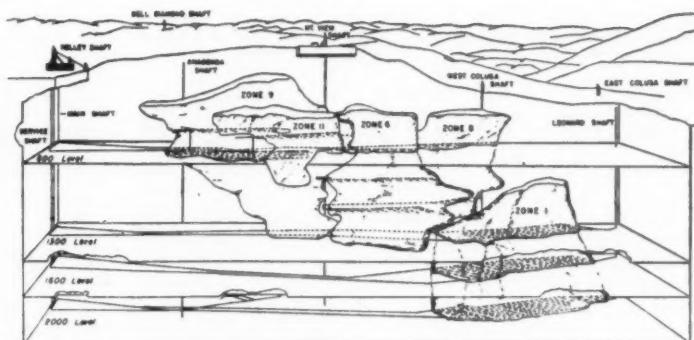
The last point may be tested by inserting an asbestos cube measuring  $1\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. x  $1\frac{1}{2}$  in. in an insulated tube immediately above a bunsen burner, a thermocouple being fitted at the top of the tube. Readings of the temperature produced are taken every quarter of a minute for 20 minutes. The gas is then turned off, the cube removed and, after the apparatus has cooled, the test is repeated first with a cube of untreated timber and then with a "Pyrolith" treated cube. The results of an actual test are plotted on the accompanying time/temperature graph.

#### Timber Need Not Increase Temperature

It is convincingly demonstrated that in practice timber need not be a contributory factor in raising the temperature to a point where it endangers other materials of high ignition temperature. In fact, the use of treated timber reduces the amount of material damage which the structure is likely to suffer. Tests by the N.C.B. have given the treated timber an entirely clean bill of health as regards the emission of poisonous gases during combustion.

The cost of treatment is based on 4s. a cu. ft. A beam of "Pyrolith" treated timber shown in the film cost £1 4s. 6d. compared with £7 6s. 8d. for an aluminium beam. The price of the steel beam shown for comparison was £1 1s., but to insulate this beam sufficiently to make it fire-safe would cost considerably more than 3s. 6d. Fabrication and erection costs are always lower in the case of timber. The lightness of timber structures also allows more modest foundations and reduces the costs of transportation, cranage, labour and installation.

# Block Caving in Montana



Block diagram of the Greater Butte copper ore bodies

**T**HE Greater Butte project—one of the major post-war mining enterprises in the U.S.—was announced by the company in 1947 after careful evaluation of future domestic copper requirements and the world copper market. Although considerable difficulties were encountered, the mine reached the full capacity of 15,000 tons a day output, as scheduled, in July, 1955.

This achievement is the result of more than 60 years of systematic work compiling and appraising geological, sampling and mining data that proved the existence of large low-grade copper zones not mineable profitably by other methods; of wide experience in mining, including 40 years of block caving in mines at Inspiration, Arizona, and the Andes, Chile; and of systematic consideration of local conditions, application of new ideas, and comparative study of mining operations and costs. Total capital expenditure on the project exceeds \$30,000,000.

The block caving method of mining consists of dividing suitable ore bodies into blocks of predetermined size and undercutting each from the bottom and, where necessary, from the sides to permit rock stresses to cave and crush the ore into fragments that can be easily handled.

The method uses the instability of the ore for caving, shear and compressive stresses for crushing, and gravity for moving the ore to drawpoints. It is characterized by descending order of mining levels, ore drawing of each level from bottom to top, and surface subsidence. In the U.S. use of this method is widely accepted.

## Block Caving at the Kelley Mine

Block caving was adopted at the Kelley Mine after careful study and experimental mining. The knowledge gained from this work was applied in mine design and in working out standard procedures for all mining operations. Many intricate problems were encountered, such as underground dormant fires and gas, timber and junk iron in old workings. These problems were overcome by careful planning, by developing new techniques and equipment, and by constant engineering control and supervision.

The new project had to be incorporated into the existing mining facilities and operations without disturbing the output of active mines.

In general, the high-grade veins and ore shoots mined by the square-set method had resulted in stopes only partly filled with submarginal ore waste. Filling the remaining openings with wet tailings was an important preliminary step.

The initial stage of the Greater Butte project includes development of 50,000,000 tons of copper-ore reserves

above the 2,000 level and mining and hoisting 15,000 tons of ore daily, equivalent to an annual output of 4,000,000 tons of ore (or 40,000 tons of copper in terms of recoverable metal). This output is in addition to the company's annual production of about 50,000 tons of copper from other mines in the Butte district.

To assure steady output by block caving, the ore zones

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By the successful use of block caving, large reserves of low-grade copper ore that otherwise could not be extracted economically are being mined at the rate of 15,000 tons a day from the Anaconda Company's Kelley Mine near Butte, Montana. This operation is described in a Bureau of Mines technical report released by the U.S. Department of the Interior as *Information Circular 7758*. The author of the report is C. C. Popoff.

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are divided into self-contained units that can be opened, developed, and mined gradually, independently, and according to schedule. The zones are divided by levels into lifts in the vertical plane and subdivided by crosscuts into blocks in the horizontal plane. Since each block is capable of yielding only a limited output, several blocks have to be drawn to make up the total daily output; consequently, a number of blocks have to be prepared ahead of schedule.

In general, the scheduled output from the Kelley mine calls for two production levels—one level under development and one being opened up by deepening a shaft.

The principal mine-development workings include the main Kelley shaft to the 3,000 level, the auxiliary Kelley shaft to the 2,000 level, main haulageways on the 600, 1,300, 1,600 and 2,000 levels leading to ore zones; intermediate levels for development and ore drawing of individual zones; transfer and service raises; and special workings for ventilation and other purposes. These workings are connected with several old shafts in the area for ventilation, drainage and safety (emergency exits).

Originally all ore was extracted by the all-gravity system. As a result of the introduction of concrete support of development workings and subsequent successful mining experiments, an increasing number of blocks are being mined by the slusher-gravity system. Output by the latter system reached 15 per cent of mine production in November, 1954, and 46 per cent of mine production in November, 1955. Plans for mine development are designed and initiated six to ten years ahead of production.

The all-gravity and slusher-gravity systems of block development, as employed at the Kelley Mine, will be more fully described in a subsequent article.

# Minerals Research in Australia

**T**HE importance of research for the development of the mining industry and the utilization of Australia's mineral resources is fully recognized by the Commonwealth Scientific and Industrial Research Organization.

Mineragraphic work to provide information on the mineral composition of ores has been in progress in Melbourne since 1927. The techniques used are highly specialized and require considerable experience, so that it is only rarely that they can be applied by the staffs of operating mines. Ore-dressing laboratories, operated in Melbourne in collaboration with the University Department of Mining, and in Kalgoorlie in co-operation with the School of Mines, investigate the composition of ores and provide advice on suitable methods for their full-scale treatment. Work on the utilization of minerals is carried out by the Division of Industrial Chemistry.

## Mineragraphic and Ore Dressing

The Organization's report for the year ending June 30, 1955, records 37 investigations of the mineral associations of rocks, drill cores and mill products submitted by mining companies and other organizations. A number of these were related to the search for new mineral deposits.

Examination of uranium ores from the Mary Kathleen lease, Queensland, revealed the presence of a new mineral, which was identified as a rare-earth borosilicate and named stillwellite, after Dr. F. L. Stillwell, former head of the Minerals Utilization Section, Division of Industrial Chemistry.

A survey was made, in conjunction with the Broken Hill Geological Research Committee, of the distribution of cadmium in the Broken Hill lode. The cadmium occurs substituting for zinc in the sphalerite of the lode, and a distinctive pattern of zinc-cadmium ratios was found in zinc concentrates prepared from different sections of the ore bodies comprising the lode. The zinc-cadmium ratios appear to increase with the progress of deposition.

Investigations into general methods of treating cobalt ores are being continued. Test work confirmed that electrostatic separation was not likely to be useful in the treatment of cobalt-manganese oxide ores. Leaching of such ores is to be further investigated and work on the gravity and flotation concentration of an ore containing cobaltite and erythrite is in progress.

An investigation was carried out with the mine staff of Morning Star (G.M.A.) Mines N.L. to determine a satisfactory method for destroying cyanide in plant residues and discharged effluent. Satisfactory results have been obtained involving ferrous sulphate and bleaching powder.

Further study of the electrostatic concentration of alluvial diamonds was undertaken. This work was done on a product from a dredge-borne jig, which contained quartz, some iron oxides, and other minor minerals. It was found that if such a product was mildly agitated when dry, the quartz became selectively more conducting, presumably due to an electrostatically conducting coating of iron oxides, and that diamonds could be concentrated in a very small bulk of less conducting product.

Projects related to various phases of extractive metallurgy were carried out by the Division of Industrial Chemistry. In general, the objective has been to devise new or improved methods for the separation of one or more metals from the various extraneous substances with which they are commonly associated in Australian ores. In some instances, however, the emphasis has been more on the isolation of some enriched or convenient compound of the metal than on the preparation of the metal itself.

There has been further work on methods of extracting copper from the calcines obtained by roasting chalcopyrite concentrates from Mount Lyell and Mount Morgan in a fluid bed. The effects of the most important variables —viz., time, temperature and acid strength—on the amounts of iron and copper leached by agitation with sulphuric acid have been assessed, and attempts have been made to correlate solubility with roasting conditions. The kinetics and mechanism of the oxidation of ferrous iron by manganese dioxide and by air were also studied, since oxidation followed by precipitation offers a promising method of removing iron, arsenic, antimony and molybdenum—elements which reduce the efficiency of the electrolytic deposition of copper. The current efficiency of deposition has been shown to be closely dependent on the iron content of the electrolyte and on those variables which influence diffusion.

The study of acid pressure leaching has been continued with a number of different Australian uranium ores. Further work was undertaken on the settling and filtration problems associated with the processing of Rum Jungle ores. Alkaline leaching procedures were investigated as a means of reducing the cost of processing local uranium ores containing large amounts of acid-consuming components. A detailed study was completed of the leaching techniques required for treatment of ore from the Mary Kathleen lease in Queensland.

## Other Investigations

Fundamental investigations into new methods for removing hafnium from zirconium have continued to yield interesting results. A lb.-scale pilot plant for separating these two elements has been designed, assembled, and successfully put into operation.

Work on an alkaline process for the decomposition of monazite has been completed. Alkaline reagents are expensive in Australia compared with the sulphuric acid used in earlier work, but the alkaline process enables simplifications to be made in the subsequent recovery steps. A relatively simple procedure for recovery, in high yield, of all major components of the mineral has been devised. The thorium concentrate so produced is amenable to purification by methods developed by the Division; lanthanum and uranium concentrates are treated by established methods. A method has also been devised for the recovery of a substantial portion of the uranium contained in the liquors which remain after the acid processing of monazite.

A chemical examination of flue dusts from metallurgical works and coal-burning plants is in progress, the objectives being to assess Australian sources of germanium and obtain data on its distribution in smelting and coal combustion operations. Examination of a wide range of products has shown that small amounts of germanium are widely distributed through Australian flue dusts, the highest relative concentrations being in flue dusts from producer-gas plants. Other types of flue dusts have not yielded enrichments of germanium sufficient for extraction by existing methods. A potentially greater quantity of germanium is available from these latter sources.

**Machinery and Equipment****Flexible Metallic Tubes for Mining**

A bronze tube of novel type, claimed to be capable of withstanding far higher pressures than is normal without undue adverse effects on flexibility, is now being manufactured by William Rose Ltd., of 21 Aldgate, London, E.C.3, who specialize in the production of flexible metallic tube assemblies.

The fact that the new tube is completely seamless, having no joints whatsoever throughout its length, is of particular interest, so far as applications in the mining industry are concerned, since the risk of leakage and contamination is thus eliminated. A further advantage claimed for this tube is that, due to its construction, no distortion or crushing are caused by heavy loads. Tests by the manufacturers have shown that the cross-sectional strength is sufficient to enable a double-decker bus weighing  $7\frac{1}{2}$  tons to pass over a tube without compressing or distorting it in any way.

It is also claimed that for holding vacuum this hose is far superior to similar tubes having longitudinal seams. The Ministry of Works recently carried out tests very successfully at a temperature of minus 55 deg. C. and a vacuum of 26 in.

This very flexible product is manufactured from solid drawn bronze tubes (85 per cent copper and 15 per cent zinc) in bores  $\frac{1}{2}$  in. to 6 in. Being constructed of a non-ferrous material, it will not perish or deteriorate in damp atmospheres.

Formed in spiral corrugations, the tubes are available with three alternative degrees of pitch—very fine, fine and standard. For normal use fine corrugations are generally found to be satisfactory. Where lengths of over 5 ft. can be accommodated standard corrugations are suitable. If extreme flexibility is demanded very fine corrugations should be used.

When a bare tube is subjected to very high pressures the tube is inclined to stretch. In order to restrict this tendency bronze or galvanized steel high tensile wire is multi-plaited to form a



sheath on the outside of the tube. For applications at very high pressures the tube is multi-braided and under these conditions the following pressures have been achieved:

- $\frac{1}{2}$  in. bore 6,000 p.s.i.
- $\frac{1}{2}$  in. bore 6,000 p.s.i.
- $\frac{1}{2}$  in. bore 4,800 p.s.i.
- $\frac{1}{2}$  in. bore 4,000 p.s.i.

The company has developed a new type of braid on which longitudinal lines are provided expressly for the purpose of indicating twist or distortion on the tube when fitting.

Two new types of end fittings have recently been developed. One is a reusable Union CC1 of the compression type, which is easily fitted when the tube is held in a ferrule. The union front which makes a seal between the tube and reinforced washer has a clamping action. Instead of a union front fixed ends can be fitted. This type of union

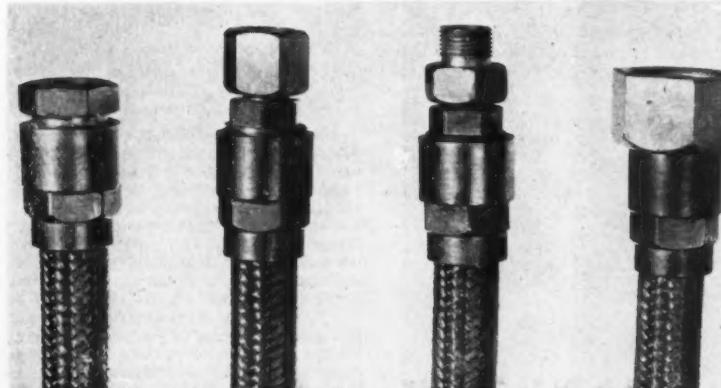
can be removed in order to allow the tube to be shortened and can then be refitted. The second type, Union CC2, is very similar to CC1, but has a metal to metal seat.

**DEMONSTRATION OF SURFACE MINING EQUIPMENT**

On Tuesday, December 11, 1956, representatives of the technical press attended an exhibition and demonstration of earthmoving and surface mining equipment at the Chaseside Engineering Co., Ltd., Herford. New items of equipment displayed for inspection were the Loadmaster 700, the Loadmaster 800 T.C., the Chaseside-Hopto backhoe and swing shovel and the Rockmover. These machines were displayed for static inspection. Also on view were the D.3 dumper and the Loadmaster 500. During an inspection of the works and production lines the new Mining Wagon, described in this column in the November 23 issue, was also shown.

The Rockmover is a modified version of the Mining Wagon, with layer wheels and a more powerful engine, and is for use above ground. The engine of the Rockmover is a 4-cylinder, 4-stroke 75 b.h.p. at 1,800 r.p.m. A.E.C. (Maudslay) diesel. The steering gear ratio is 24:1.

The hopper is of heavy steel plate construction  $\frac{1}{2}$  in. thick at the floor and back and with  $\frac{1}{2}$  in. plate sides. The body is tipped by two hydraulic jacks. Payload



Alongside, examples of flexible metallic tubes for mining and above, the Chaseside Rockmover

is 17,500 lbs. and heaped capacity of the hopper 6.65 cu. yd. S.A.E. (1:2). Tipping cycle at 1,800 r.p.m. is 6.2 secs. and maximum tipping angle 75 deg.

Performance calculations reveal a loaded radius of 24 in., a gross weight of 15 tons, and a minimum turning radius of 11 ft. 7 in. nearest inside and 22 ft. extreme outside. The machine is 15 ft. 10 in. long, 8 ft. 9 in. high to the cab top, and 8 ft. wide.

The Standard Loadmaster 800 T.C. has a lifting time to full height of 5 secs., a lowering time to ground level of 3½ secs., and a scoop recovery at 1,200 r.p.m. of 3 sec. Payout angle at ground level is 35 degrees. The Loadmaster 700 has identical lifting and lowering times and scoop recovery. It has a digging thrust of 6,000 lb.

The hopper of the Superbe dumper carries 3.7 cu. yd. (British Dumper Rating) or 4.25 cu. yd. (S.A.E. Rating). The specially designed chassis incorporates a large diameter torsion tube and longitudinal stiffeners whilst heavy bumpers welded to either end provide additional bracing.

#### A NEW TYPE CUTTER LOADER

A cutter-loader which can be used in seams 18 in. to 3 ft. in thickness has been designed at Hartley Bank Colliery, near Wakefield.

The machine consists of a longwall coal-cutting machine fitted with a five-foot cutting jib and chain. At the end of the cutting jib a mushroom pulley with cutting picks is fitted, to make a vertical cut up the coalface at the end of the undercut coal. The height of the mushroom pulley depends upon the thickness and the nature of the parting between the coal seam and the roof.

The loader end consists of a normal coal cutter jib which can be fitted with either picks or flights. This is driven by a sprocket wheel on the top of a vertical shaft connected by a chain to a similar sprocket on an extended vertical shaft which also drives the normal jib of the coal cutter.

**Below, the Hartley Bank cutter loader and at right, a Stag ball mill**

The cutting and loading ends are joined together by a strong plate bridge which also encloses the driving chains. It is through this bridge that the coal is passed on to the face conveyor belt.

Fitted to the loading jib is a strong inverted plate which acts as a plough. This pushes the coal into the space between the cutting jib and the loader, when it is carried through the bridge to the face belt by both cutting jib and loader jib.

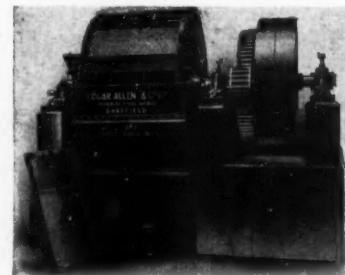
The machine will cut and load in either direction, the plough being changed in the stable at either end of the coalface. The machine is pulled along the coalface by rope. A prop-free front is not required, nor are special roof bars necessary. The new cutter loader can be used in conjunction with a bottom belt face conveyor.

#### GRINDING EQUIPMENT FOR MINES AND QUARRIES

The demarcation line between crushing and grinding is by no means well defined but ball mills and tube mills are regarded as falling within the latter category. Stag ball mills, manufactured by Edgar Allen and Co. Ltd., consist of a drum with peripheral grinding plate and outer sieves, and fairly large steel balls are used as grinding medium on a coarse feed to produce a relatively coarse product. This type of machine is specially suitable for the reduction of mineral ores, quartz, etc. It is generally used for the dry grinding or crushing of ores. The mesh of the outer screens is usually between 5 and 60 per linear inch, the size of feed being normally about 2 in.

The tube mill is usually long in relation to its diameter. It uses smaller balls than the ball mill and produces a finer product. In its simpler forms it is suitable for fine grinding for fillers and may be used for either wet or dry materials. The material to be ground, however, must be either quite dry for fine grinding, or mixed with sufficient water to form a sludge or slurry for wet grinding.

The combination Stag tube mill is virtually a combination of ball and tube mill since it is made up of a cylinder divided into two or more compartments by perforated partitions. Preliminary grinding takes place at the face end and



finish grinding at the other. The preliminary chambers are normally lined with stepped liners in Cromax chromium alloy cast steel, and the finishing chambers with hard cast iron liners. Steel balls of varying sizes are used as grinding media. This type of mill is eminently suitable for grinding raw materials and various kinds of ore.

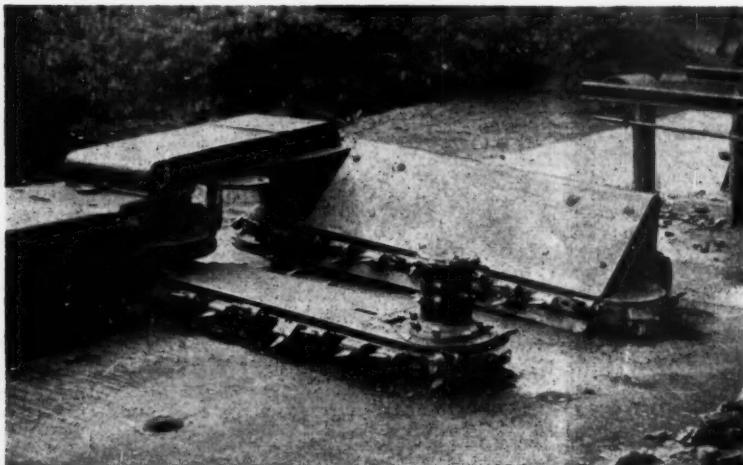
It is thus evident that the simple term "crushing" covers a very wide range of equipment and applications. In planning the reduction plant for a particular operation, consideration should be given not only to the most suitable type of machinery, but also to such factors as positional site and size of unit. In many instances ancillary equipments to the crushing process are also of considerable interest; e.g. the ore storage pocket recently constructed at the Roan Antelope copper mine in Northern Rhodesia, and the transportation and crushing system installed at the Salmo property of Canadian Exploration Ltd. At Salmo 3,600 tons of ore per day from lead-zinc and tungsten mines are transported to the respective mills, crushing being performed en route.

#### A QUANTOMETER FOR PRODUCTION CONTROL

A new instrument at the Stocksbridge works of Samuel Fox and Co., Ltd., a subsidiary of The United Steel Companies, Ltd., is cutting the time taken to analyse samples of stainless steel to a quarter—from one hour to 15 minutes. Known as a quantometer, the Swiss-made instrument provides direct readings of the elements contained in a steel sample in as little as four minutes, although it takes several minutes extra to prepare the sample for examination and a little longer to convey it from the melting shop to the laboratory. Designed for the determination of 17 elements in ranges from a trace up to 30 per cent, the instrument can provide an analysis for manganese, nickel, chromium, molybdenum and copper.

The quantometer operates in conditions of close atmospheric control. Temperature is maintained at 70 deg. F.

The instrument consists of three units: first the multi-source unit which supplies excitation conditions across the analysis gap, causing spark-like or arc-like discharges, as desired, to the sample under analysis; second the spectrometer, which forms a spectrum from the light released by the discharge, enabling the wavelengths of elements in the sample to be isolated and their light energy to be transformed into electrical charges; and third the recording console, housing all the necessary high and low voltage power supplies, integrators, amplifier, sensitivity controls and switching circuits.



## MINING MISCELLANY

Owing to hostilities in Sinai, operations at the Sinai Mining Company have ceased. Management and control of the company was transferred to Egypt in 1952.

A new tunnelling record was claimed by Czechoslovak miners at the Pribram mines on November 7, when they completed a cut of 1,021.30 metres in one month.

The British Metal Corporation, through its South African subsidiary, has been appointed sole agent for sales of copper concentrates produced by Magundi Copper Mines and Minerals.

The Montecatini Co. has decided to build an aluminium works at Crotone, near Catanzaro, which will be the first of its kind in Southern Italy. Montecatini owns a large mine in Calabria.

A manganese deposit has been found in the neighbourhood of Jundiai in the State of São Paulo, Brazil. Details of the size of the deposit are not yet available.

Steps are being taken by South African Minerals Corporation to expand its manganese output to approximately 13,000 tons per month by the end of 1957. Production in the September quarter averaged 5,000 tons per month.

Total gold output by S.A. mines during November fell by 21,637 oz. to 1,345,854 oz. For the purposes of declaration a value of 250s. 10d. per oz. was taken. Native labour employed at 311,853 compared with only 299,259 in the corresponding month of 1955.

A mission has left Bolivia for Japan to explore the possibilities of marketing copper, wolfram, zinc and antimony in that country. At the same time it will try to engage experts for private and state-owned mines in Bolivia. The mission is led by the president of the Bolivian Mining Bank, Sr. Jorge Salazar Mostajo.

According to Mr. S. N. Shukla, Minister for Forests and Natural Resources, Madhya Pradesh, the Government of India proposes to spend Rs. 40,000,000—50,000,000 on the introduction of mechanized diamond mining in Panna, by which, it is expected, the present rate of production will be substantially increased.

Our Correspondent in Ceylon reports that the Government has sent S.O.S. calls to several countries for gypsum. This is because gypsum imported from India has been found unsuitable for use as a material for cement production at Kankasenturai in North Ceylon. It has been officially stated that suppliers of gypsum in Sicily and Pakistan have been approached by the Government to rush supplies to Ceylon.

An aluminium plant and rolling mill was recently put into operation at Sibenik, on the Adriatic coast of Yugoslavia. Initial production will be 4,000 tons of aluminium products, but in 1958, when full capacity is reached, output will be 16,000 tons. Yugoslavia invested about \$33,000,000 in the construction of this plant and expects to amortise this outlay in five years.

The Otavi Minen und Eisenbahngesellschaft (Otavi Mining and Railway Co.) has resumed its activity in South Africa following the South African Government's release of £100,000 of the company's requisitioned property. Most of this sum was used for reconstruction work on a platinum mine in the Transvaal which had been idle for 26 years. The mine resumed production in October this year.

The Japanese firm, Mitsui Mining and Smelting Co., has agreed with the cooperation of the Thai firm of Yip in Tsoi, to launch a joint mining venture in Thailand with a capital of Baht 18,000,000. Yip in Tsoi is contributing 51 per cent of the capital, the balance to be paid by the Japanese company, which will also supply mining machinery and equipment. Work will begin soon on four partially developed wolfram and tin mines in South Thailand. Further prospecting licences in the area, where road development is taking place, have been taken out by Mitsui.

It is reported from Manila that last year the Philippines exported chromite worth \$6,153,688 to the U.S., this figure being exceeded only by Turkey with shipments over \$9,000,000 in value. The Central African Federation with shipments valued at over \$5,000,000 ranked third. A new Philippine producer, Palwan Consolidated Mining Co., recently sent its first shipment of 2,000 tons of high grade metallurgical chromite to Philip Bros., Inc., of New York, the firm which holds the 1956-57 buying rights. The shipment was valued at \$110,000.

The Canadian Nickel Co., an Inco subsidiary and Kennarctic Exploration, a subsidiary of Kennecott Copper Corporation, were the successful bidders on two large concessions recently let by the Canadian Government in the Northwest Territories. The concessions, known as the Coppermine River Reservation and the James River Reservation, comprise approximately 602 and 620 square miles respectively. Over a four-year span Canadian Nickel will expend \$1,750,000 and Kennarctic \$1,800,000 in exploring the properties.

Stauffer Chemical Co. has purchased a 50 per cent interest in San Francisco Chemical Co., subsidiary of Mountain Copper Co. and an important producer of phosphates. San Francisco Chemical has been producing sulphuric acid from the heavy sulphide ores of Mountain Copper's properties in the Shasta Copper Belt, using the acid for processing

phosphate rock from its own mines in Idaho.

Final arrangements are being made by the Bateman Mining Co., of Canada, for an intensive diamond drilling campaign to be conducted from lake ice. As the programme gets under way, as many as 12 rigs may be employed on the ice. The objective is to search for ore-bearing extensions of zones already drilled indicated on and near Gouin Peninsula, as well as for extensions of the Nos. 1 and 2 ore bodies of Chibougamau Jaculet Mines Ltd., whose property lies west of Bateman Bay Mining's property in the Chibougamau copper mining area, Quebec. The general aim is to prepare the way for shaft sinking and underground development next spring.

New Mine Sapphire Syndicate, a British syndicate, has sold all but five per cent of its stock to Colorado and Montana interests which plan to resume operations in the immediate future. The syndicate owns the Yogo sapphire deposit in Judith Basin County, Montana, which produces sapphires of the highest quality and is considered the most important gem deposit in the United States. Production during the first quarter of the century is estimated at \$30,000,000 in cut stones but operations ceased in 1927 because of double taxation and currency difficulties for a foreign owned company.

The Luossavaara - Kiirunavaara AB (LKAB) of Kiruna, in Northern Sweden, are proposing to employ television in their mines to save manpower and increase safety. The intention is to use television cameras primarily for "checking" the ore as it is fed on to the belt conveyors. It is estimated that it should be possible to effect a marked saving in manpower throughout the 24-hour working cycle. On December 4 a trial transmission was arranged at LKAB's central plant.

The World Bank has made a loan of \$50,000,000 to the Commonwealth of Australia to finance imports of equipment for the development of agriculture and forestry, road and rail transport, industry and mining. Industry and mining will receive \$16,000,000, which will provide the foreign exchange necessary to import specialized equipment necessary for expanding output and increasing efficiency in the iron and steel, engineering and food processing industries and in the mining of lead, zinc, copper and coal. The loan is for a term of 15 years and bears interest at 4½ per cent, including the 1 per cent commission charged by the Bank. Amortisation will begin on July 15, 1959.

The Organization for European Cooperation (O.E.C.C.) has decided to set up an Energy Committee of high officials from member countries to discuss energy problems and make proposals which would be binding on member governments if approved by the

Council. The five members of the Energy Advisory Commission will be appointed from experts proposed by member countries and the High Authority of the European Coal and Steel Pool. They will have a three-year term of office. The Commission is to submit before January 1, 1959, a report on member countries' energy needs and production for the years 1960, 1965 and 1975.

★

Metallic corrosion is costing the U.K. about £600,000,000 annually, and without prejudice to existing research stations at Corrosion Research Station on a truly national basis should be set up to tackle the problem, Dr. W. H. J. Vernon told members of the Institution of Civil Engineers at a meeting on November 29. He pointed out that this vast sum only represented the probable cost of maintenance of metal installations, plus the cost of the equipment which corrosion makes unserviceable every year. The indirect costs of breakdowns from such items as perforation in a condenser tube are incalculable.

★

Deposits of rich iron ore have been discovered in the Northern Central Province of the Republic of Liberia by a joint Liberian-American-Swedish enterprise, Lamco (Liberian-American-Swedish Minerals Co.), which is under Swedish management. According to information received the deposits are of hematite ore with a 60 per cent ferrous content, but it is not yet known whether they are large enough to make mining profitable. A test drilling programme has been started and is being carried out by Svenska Diamantbergborningar AB (Swedish Diamond Drilling Co.).

★

A review by D. M. Traves, entitled "The Geology of the Ord-Victoria Region, Northern Australia," has been published by the Bureau of Mineral Resources, Geology and Geophysics of the Department of National Development, Commonwealth of Australia. It presents the results of a geological reconnaissance undertaken primarily to provide a geological background for assessment of land utilization, but also to provide information on the stratigraphy and economic geology. Mineral production for the Kimberley Field is listed and occurrences of gold, silver, lead, tin, copper, ochre and bauxite are discussed. Aerial scintillometer surveys are recommended to determine whether uranium deposits occur in the Halls Creek metamorphics.

#### PERSONAL

The Council of the Organization for European Economic Co-operation (O.E.E.C.) has appointed Dr. Alexander King, deputy director of the European Productivity Agency. On January 1, 1957, he will succeed Mr. Edwin Fletcher, who has returned to the T.U.C., from which he was seconded in 1955.

★

Mr. C. Hand has been appointed to the board of Sheepbridge Equipment Ltd., a subsidiary of Sheepbridge Engineering Ltd.

★

The death has occurred of Mr. W. S. Naylor, who was chairman of the

Chloride Electrical Storage Co. Ltd. from December, 1929, until July, 1946.

★

Mr. H. H. Lusty has been appointed manager of the Publicity Department of Metropolitan-Vickers.

★

The Institute of Metals (Platinum) Medal for 1957 has been awarded to Dr. Maurice Cook, joint managing director of Imperial Chemical Industries Ltd., Metals Division. The Rosenhain Medal for 1957 has been awarded to Dr. H. K. Hardy, research manager, U.K. Atomic Energy Authority, Industrial Group.

★

The name of The Chartered Bank of India, Australia and China has been changed to The Chartered Bank, with effect from December 6, 1956.

★

The Chancellor of the Exchequer will be the guest of honour at a dinner to be held at the Savoy Hotel, London, on February 5, 1957, to mark the 75th anniversary of the London Metal Exchange.

★

The National Metallurgical Laboratory, Jamshedpur, India, has arranged a symposium on Mineral Beneficiation and Extractive Metallurgical Techniques. It will be held at Jamshedpur from February 5-8, 1957.

★

The next Luxembourg International Trade Fair will be held from May 25 to June 9, 1957.

★

The annual general meeting of the Institution of Mining Engineers will be held on January 31, 1957.

★

"Records of the Geological Survey of Uganda 1954" has been published by the Uganda Government. It is available from the Government Printer, P.O. Box 33, Entebbe, at a price of Shs. 7/50.

★

The second brochure of the Sixth Commonwealth Mining and Metallurgical Congress, Canada (Sept.-Oct., 1957) has been issued from Vancouver and contains forms of registration as well as detailed information. Copies can be obtained by direct air mail application to the Executive Secretary at 837 West Hastings Street, Vancouver 1, British Columbia.

★

An illustrated publication entitled "Nickel Plating for Engineers" has been issued by the Mond Nickel Co., Ltd., Publicity Department, Thames House, Millbank, London, S.W.1, from whom copies are available free of charge. It has been written primarily for engineers, designers and others interested in the possibilities which plating offers in design. Much of the information is in the form of graphs or tables.

★

"Soldering Aluminium Cables" is the title of an illustrated handbook issued by the Aluminium Union Ltd., The Adelphi, John Adam Street, London, W.C.2., from whom it is available gratis on request. Among the appendices are a list of suppliers of all the necessary materials and comprehensive quick-reference current rating tables for aluminium cables.

A new handbook designed specifically for persons interested in uranium prospecting and development has been issued by the Bureau of Mines, U.S. Department of the Interior. Entitled "Facts Concerning Uranium Exploration and Production," this publication is available at 70 c. per copy from the Superintendent of Documents, Government Printing Office, Washington 25, D.C. It is not for sale by the Bureau of Mines.

★

The Rhodesian Selection Trust Ltd., with the advice and collaboration of Mr. Geoffrey Crowther, until recently editor of *The Economist*, has decided to establish a journal to be published in the Federation of Rhodesia and Nyasaland, which will be known as *The Central African Examiner*. It is intended that the journal should meet the need for a publication, predominantly serious in content, which will draw its readers from thoughtful people in all sections of the community. A board of trustees has been appointed, its main responsibility being to safeguard the integrity of the journal and the independence of the editor. The trustees are Sir Robert Tredgold, K.O.M.G., Q.C., Chief Justice of the Federation; the Rt. Rev. Oliver Green-Wilkinson, and Dr. Walter Adams, C.M.G., O.B.E., principal of the University College of Rhodesia and Nyasaland.

#### AGENCIES WANTED

Patricia Engineering 1951 Ltd., P.O. Box 370, Ferris, Ontario, Canada, are interested in representing U.K. manufacturers. They state that there is still a preference in Canadian metal mines for battery or electric locomotives but some mines are gradually swinging round to diesels. The firm would prefer to represent a manufacturer who can offer a range of battery, trolley and diesel mining locomotives up to 100 h.p. They are also interested in representing manufacturers of dumpers suitable for underground use, rotary tipplers, and main underground ventilation fans. Manufacturers interested should write direct to Mr. R. J. Laidlaw, president of the Canadian firm, at the same time notifying the U.K. Trade Commissioner, 119 Adelaide Street West, Toronto, that they have done so. B.O.T. Ref.: ESB/29921/56. Telephone enquiries to Chancery 4411, extension 776.

#### CONTRACTS AND TENDERS

A Wiltshire firm of engineers, Spencer (Melksham) Ltd., has secured an order valued at over £400,000 for mechanical handling equipment for Angola. The contract was placed by the Portuguese Ministry of Overseas Territories and the equipment being supplied is for handling large quantities of manganese ore and zinc concentrates.

★

The Woodall-Duckham Construction Co. has received a further order from the South African Iron and Steel Industrial Corporation for coke oven installation valued at some £2,000,000 for its Vanderbijl Park works. This is the ninth battery of W-D Becker coke ovens to be ordered by Iscor and comprises 55 ovens, as does a battery now nearing completion at Vanderbijl. Two further batteries of 51 ovens are under construction at the Pretoria works. The total value of these four contracts is nearly £6,000,000.

## Metals and Minerals

# Aluminium in the Next Four Years

The current outlook for processors and fabricators of aluminium in the U.S. is that no trouble will be experienced in the immediate future in obtaining adequate supplies. For the first time for a couple of years apparent production and supply are ahead of demand. The industry expects to go into the first quarter of 1957 with relatively substantial stocks, but any pronounced upsurge in demand, more particularly from the automotive and construction industries, could reduce sharply any excess of supply until new primary capacity is brought later in the year.

Apart from this factor, the general opinion seems to be that the supply outlook for the next three or four years is more than good. On a long range basis the Business and Defence Services Administration forecasts the available supply through 1960 as exceeding the presently indicated consumption by roughly 1,000,000 tons. The main reason that no plans are being made to curtail expansion programmes is that the BDSA projection makes no provision for any calls for stockpiling, while forecasts of probable consumption are based largely on historical patterns and provide for an annual increase of 10 per cent in each of the four years. Industry believes it can do better.

The immense water requirements of aluminium producers are the subject of a report by the U.S. Geological Survey, emphasizing that the aluminium industry uses as much water as a fair-sized city. The average water use in 1952 was about 16 gal. per lb. of aluminium produced from bauxite. Changes in plant operation, planned or started, are expected to increase the unit water use to about 23 gal. per lb. of aluminium.

\*

Aluminium exports from Canada in the third quarter of 1956 rose to 123,026 tons, which compares with 101,143 tons in the first three months of the year. This improvement reflects higher production of primary metal in the Dominion, following the resumption of full operating capacity and output from new facilities. Nevertheless total Canadian export shipments through the first three-quarters amounted to only 344,689 tons against 399,043 tons for the corresponding nine-month period in 1955. Shipments to the U.K. totalled 158,900 tons and U.S. buyers received 152,203 tons. Indications are that Canadian shipments to the U.S. are likely to be at least 30,000 tons short of the original goal of 250,000 tons.

### NICKEL PRICES

At the time of writing Falconbridge had reached no formal decision on prices following the increases recently announced by Inco. However, it was indicated that Falconbridge's prices would probably be similarly adjusted. Sherritt-Gordon Mines Ltd. has indicated that all of its nickel production is sold under contracts which provide that its price will follow

the "general level". In the U.S. the advance of 9½ c. to 74 c. a lb. in the price paid for electrolytic nickel has caused Revere Copper and Brass, Inc., to raise its prices for nickel-bearing alloys by a range of ½ to 2½ c. a lb., depending on the nickel content.

The U.S. Senate Committee on Small Business has declared that defence requirements take 40 per cent of the country's nickel supplies. The committee expressed its dissatisfaction with the present method of allocation of nickel by the Business and Defence Services Administration to defence and civilian users. The electroplating industry, it was stated, had not been receiving an equitable share of the available supply of non-defence nickel. The Committee declared that real relief for small users of nickel could only be brought about through increased production of the metal.

In Canada demand for nickel has boosted prices on the free market to \$1.50 a lb. Inco's Canadian price is 70 c. North Rankin Nickel Mines Ltd. reported two offers from Europe to sell 4,000,000 tons of nickel at prices double the market level. The source of the European demand was not disclosed.

The free nickel market in London continues as firm as ever, according to trade quarters, who say that the uncertainties at present felt regarding European consumption because of fuel shortages do not appear to have had any visible effect on sentiment. It is pointed out that the various plans to expand production of the metal will not become a market factor for some time, and that tight conditions still obtain. Very high prices continue to be heard of on the Continent in the region of £2,300 and £2,400 per ton, while in the United Kingdom a price of £1,500 to £1,600 per ton is indicated, or nearly three times the recently advanced price of £600 per ton at which most of Britain's requirements are obtained.

### BERYLLIUM COPPER PRICES

A U.S. producer has announced that there will be no price increase in beryllium copper at this time in spite of a general increase in copper and brass mill products. In addition, no changes in beryllium copper scrap are at present planned. This is in line with the policy of making beryllium copper more competitive.

### LOWER RUTILE PRICES

There has been a further easing in Australian rutile shipment prices. Demand, which recently slackened considerably, still shows no signs of revival and the price outlook for the time being is viewed with uncertainty. The Bureau of Mineral Resources in Australia has warned intending new producers of rutile to take careful stock of the market in the next few years before proceeding with their plans.

### PAKISTAN CHROMITE EXPORTS

Following the closure of the Suez Canal, the production of Pakistan Chrome Mines, Ltd., which is usually exported to Britain, has been going to Japan. Output from the workings of Pakistan Industries, the other main producer, was already going to Japan. A U.S. firm has been buying Pakistan Industries' production and has contracted to buy up the whole of its 1957 output. Trade estimates of 1956 production are 32,000 tons.

### TELLURIUM PRICE RAISED

With effect from December the American Smelting and Refining Co. has increased its price for powdered tellurium from \$1.50 per lb. to \$1.65 for 100 lb. lots. This is the first increase for 2½ years.

### MOLYBDENUM PELLETS

Molybdenum pellets of high purity and high density are being produced in quantity by an American firm, Sylvania Electric Products, Inc. They are designed specifically to meet the need for inexpensive, highly uniform molybdenum in vacuum smelting. The pellets are approximately 99.85 per cent molybdenum, with a density of 7 grams. per cu. centimetre. They are about 1 in. in diameter and a half inch high, and are priced at \$4 a lb.

### URANIUM IN THAILAND

A plan to develop uranium mines in Thailand to assure an adequate supply of atomic fuel for the Japanese atomic industry is being studied by the Komatsu Manufacturing Co. of Japan. The company recently sent to Thailand a high-ranking official to conduct a month-long survey of the uranium mines there and the results of his finding are now being studied. No concrete plan for the method of development of the uranium mines in Thailand has yet been worked out, but the project is likely to be a joint venture between Komatsu and Thai mining companies.

### PHILIPPINE QUICKSILVER

Palawan Quicksilver Mines, the first mercury producer in the Philippines, has reached a stage where its operations are stabilized and a steady monthly production assured. It has been granted, and since September has been using, barter licences for 100 per cent of its production. During October the company's reduction plant treated 3,896 tons of cinnabar for a production of 22,507.7 lb. of mercury valued at approximately 152,000 pesos.

COPPER	TIN	LEAD	ZINC
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### COPPER QUIET

The world copper markets are still becalmed. In the United States the big producers are still quoting 36 c. per lb. and the custom smelters are shading that price a little for January or first quarter delivery. In the export market copper is passing at 35 c. or even under, but, with the exception of Japan, demand is not brisk. There is now no hope of any pickup for 1956 for the Christmas holidays are almost here; there is little reason to believe that demand in the United States will be any brisker in January either. The brass mills are operating at around 70 per cent capacity and awaiting better orders from Detroit. Detroit is frankly puzzling. The stories of sales of new model cars ought to imply bigger buying of copper, but somehow the brass mills do not get any more business. The wire mills have been better placed but with the winter at hand there is always some slackening off in work on outside power lines. However, unless there is a real fall in copper buying any significant change in price is not to be expected.

In frankly bearish circumstances the news of strikes is apt to be taken lightly. In Chile the copper miners have rejected the offer made at Chuquicamata by Anaconda. Anaconda's offer is believed to be worth 1,000,000,000 pesos while the miners are still hoping for much more than twice that amount. The Chilean government has not yet declared its stand. Even to permit the company's offer would be to allow a blow to its stabilization programme; to permit much more may well be disastrous. Negotiations are continuing.

At Bancroft there has been a strike of European miners. Two hundred and fifty men who struck last Saturday, have not yet returned to work. The 250 struck in favour of 13 artisans who had a dispute with the management and who had walked out in protest.

### TIN HEADED DOWN ?

Trading began last Monday in the new Straits futures tin contract in New York (metal bearing brands of the Straits Trading Company and Eastern Smelting Company are tenderable) and produced the heaviest day's trading in a year.

Tin has declined steadily in the past week in New York in sympathy with easier trends elsewhere and with the easier turn of events in the Middle East. Spot straits metal which was 109 c. on December 6 had fallen to 104.25 c. on December 12. There seems no reason why the decline should not go further in the next few weeks since there is still a considerable "scare" element in the price. The contracts for the Texas smelter have now been completed and the ore that would otherwise have gone there should now be becoming available. Lay-off of Texas workers has begun and it is expected that the sale of the facility will be completed by the end of December. Meanwhile A. Strauss gives its opinion that the effect of closing the

Suez Canal will be once for all so far as tin is concerned. The argument is that tin is so sought after as a ballast that there will be ample shipping available and that as soon as the first ships have made the trip round the Cape the flow of supplies will be normal, or nearly so. This is an interesting suggestion deserving respect for its source but many will want to see more evidence in support. It is certainly a bearish point as is the release of Board of Trade stocks—discussed in Notes and Comments.

### SUEZ HITS LEAD USAGE

Lead sales in New York have been modest but steady in the past week. The price is unchanged at 16 c. per lb. Business is comfortable but by no means exciting and the American industry does not relish the prospect of a decline in lead consumption in Europe because of the consequences of Suez. The rationing of petrol, which is now virtually spread all over Europe, will certainly affect the market for tetra-ethyl although this is not anything like so important an outlet for lead in Europe as in the United States. There are also continuing rumours that the British government intends to cut the building programme. Whether it will do so depends on whether it thinks inflation or deflation is now the enemy; but certainly building cuts could hit lead hard.

For the same reasons the United States is not too happy about the release of lead from the Board of Trade's stock. True it will be sold so as to do as little damage as possible to the market; but the market is in no shape to take extra quantities of metal. It is being said that the metal will go into the American stockpile via the barter programme. This is by no means certain. It is quite definite that the United Kingdom could not get rid of stocks in this way directly—the Commonwealth farming interests would see to that. Whether the American bartering programme can be nicely adjusted to take account of sudden market changes such as this is also far from certain. The barter programme is intended to keep new-mined metal off the market, not to absorb the metal the market already has.

### U.S. ZINC STOCKS DOWN

The market for zinc has been featureless in the past week in the United States. The price is unchanged at 13.50 c. per lb. East St. Louis for prime western grade and interest from both galvanizers and die casters is much the same. The figures for slab zinc for November make interesting reading. Smelter output was 91,808 tons—a slight decrease but still a high figure. Domestic consumers again took a useful total—82,478 tons; this was also slightly less than the previous month. On the month the stocks held by producers fell by 18,625 tons to the still substantial figure of 70,185 tons. This fall was due to stockpile activity which accounted for no less than 27,168 tons—14,098 tons of domestic metal and 13,070 tons of bartered metal.

### The London Metal Market

(From Our L.M.E. Correspondent)

Undoubtedly the main item of interest during the week under review to the metal trade generally has been the two announcements by the Board of Trade of their intention to make arrangements for the reduction of their stocks of lead, zinc and tin in accordance with the declared policy of liquidating some of the British government's strategic holdings of industrial raw materials.

In the case of lead and zinc, the announcement which was made on December 7 stated that no sales would take place before mid-January, 1957, but gave no indication of what quantities would be involved or when the metal would actually be available. There is no reliable information as to what the stocks are, and thus it is difficult to predict what the long-term effect will be on the market generally, but there are two other factors which may be taken into account when considering this; namely, the possible effects on industry of the oil shortage which has been mentioned previously, and secondly, a feeling in New York metal circles that December may be the last opportunity domestic sellers will have of selling to the U.S. government for their domestic stockpile programme.

If, in fact, this second point proves to be correct, it is clear from the financial point of view that the sooner the material is marketed the better. In any event, as was only to be expected, the announcement had an immediate effect on both metals.

The news about the proposed reduction in tin stocks was known in London on December 12. In this case the main factor affecting the disposal arrangements is the government's obligation to adhere to the terms of the International Tin Agreement. This agreement incorporates a clause to the effect that any participating government intending to dispose of non-commercial stocks of the metal must give six months' notice of its intentions, at the same time indicating the tonnage involved. Thus the government have declared the tonnage at 2,500 but sales cannot commence before June 12, 1957.

At the time of writing no further details are known. Prior to this announcement the three months' tin quotation in London had already fallen during the past week approximately £40 per ton with a corresponding decline in the Eastern market. The immediate impact of the announcement on prices was not so drastic as might have been expected, and by the close of Wednesday morning's market a fall of only about £5 was registered.

It is to be hoped that full consultation will take place with representatives of all interested parties so as to reduce to the minimum any disturbance to the markets which might result from the disposal of these materials. On Thursday morning the Eastern price was equivalent to £804 per ton c.i.f. Europe.

Copper values have held up well this week, which is perhaps surprising in view of the general economic outlook and the improvement in world production. A certain amount of covering against the possibility of sterling devaluation had undoubtedly been taking place recently, but the government have made clear their intention both by word and deed to do everything possible to prevent this.

Closing prices and turnovers overleaf.

## LONDON METAL AND ORE PRICES, DECEMBER 13, 1956

## THE WEEK ON THE L.M.E.

	December 6		December 13	
	Buyers	Sellers	Buyers	Sellers
<b>COPPER</b>				
Cash ..	\$272½	\$273	\$273	\$273½
Three months ..	\$274	\$274½	\$274½	\$275
Settlement ..		\$273		\$273½
Week's turnover	4,150 tons		4,025 tons	
<b>LEAD</b>				
Current ¼ month	\$115½	\$115½	\$114½	\$114½
Three months ..	\$114½	\$115	\$113½	\$114
Week's turnover	4,950 tons		4,100 tons	
<b>TIN</b>				
Cash ..	£830	£831	£799	£800
Three months ..	£823	£824	£786	£787½
Settlement ..		£831		£800
Week's turnover	645 tons		1,205 tons	
<b>ZINC</b>				
Current ¼ month	£101½	£101½	£99½	£99½
Three months ..	£97½	£97½	£95½	£95½
Week's turnover	2,825 tons		3,500 tons	

## METAL PRICES

**Aluminium, 99.5% £198 10s. per ton**

Antimony—

English (99%) delivered, 10 cwt. and over £210 per ton  
**Crude** (70%) £200 per ton  
 Ore (60%) based 23s. 6d./24s. 6d. nom. per unit,  
 c.i.f.

**Arsenic, £400 per ton**

Bismuth (min. 1 ton lots) 16s. lb. nom.

**Cadmium 12s. 0d. 1b**

**Cerium (99% nett), £13 18s. lb. delivered U.K.**

**Chromium, 6s. 1 Id. lb.**

**Cobalt.** 21a. 1b

ORES AND OXIDES											
Bismuth .. . . . . . . . . . . .	..	..	..	..	..	..	..	..	..	65% 8s. 6d. b.c.i.f. 18/20% 1s. 3d. 1b. c.i.f.	
Chrome Ore—											
Rhodesian Metallurgical (semifriable) 48%	..	..	..	..	..	..	..	..	..	£17 8s. 0d. per ton c.i.f.	
" Hard Lumpy (45%)	..	..	..	..	..	..	..	..	..	£17 8s. 0d. per ton c.i.f.	
" Refractory 40%	..	..	..	..	..	..	..	..	..	£12 15s. 0d. per ton c.i.f.	
" Smalls 42%	..	..	..	..	..	..	..	..	..	£15 0s. 0d. per ton c.i.f.	
" 18s. 6d. per ton c.i.f.	..	..	..	..	..	..	..	..	..	£18 15s. 0d. per ton c.i.f.	
Baluchistan Columbite, 65% combined oxides, high grade	..	..	..	..	..	..	..	..	..	190s./205s. per unit	
Fluorspar—											
Acid Grade, Flotated Material	..	..	..	..	..	..	..	..	..	£22 per ton ex. works	
Metallurgical (75/80% Ca F <sub>2</sub> )	..	..	..	..	..	..	..	..	..	15s. 6d. ex. works	
Lithium Ore —											
Petalite min. 34% Li <sub>2</sub> O	..	..	..	..	..	..	..	..	..	£8-£10 per ton f.o.b. Beira	
Lepidolite min. 3½% Li <sub>2</sub> O	..	..	..	..	..	..	..	..	..	£8-£10 per ton f.o.b. Beira	
Amblygonite basis 7% Li <sub>2</sub> O	..	..	..	..	..	..	..	..	..	£35-£40 per ton f.o.b. Beira	
Magnesite, ground calcined	..	..	..	..	..	..	..	..	..	£28 0s./£30 0s. d/d	
Magnesite Raw (ground)	..	..	..	..	..	..	..	..	..	£21 0s./£22 0s. d/d	
Molybdenite (85% basis)	..	..	..	..	..	..	..	..	..	8s. 5d. nom. per lb. (f.o.b.)	
Titanium Ore —											
Rutile 95/97% TiO <sub>2</sub>	..	..	..	..	..	..	..	..	..	£90 per ton c.i.f. Aust'N	
Hematite 52/54% TiO <sub>2</sub>	..	..	..	..	..	..	..	..	..	£11 per ton c.i.f. Malayan	
Wolfram and Scheelite (65%)	..	..	..	..	..	..	..	..	..	226s./231s. 6d. per unit c.i.f.	
Manganese Ore Indian											
Europe (46% 48%) basis 155s. freight plus 15% surcharge	..	..	..	..	..	..	..	..	..	140d.-150d. nom. per unit c.i.f.	
Manganese Ore (43%-45%)	..	..	..	..	..	..	..	..	..	115d. nom. per unit c.i.f.	
Manganese Ore (38%-40%)	..	..	..	..	..	..	..	..	..	110d. nom. per unit. (including duty)	
Vanadium —											
Fused oxide 90-95% V <sub>2</sub> O <sub>5</sub>	..	..	..	..	..	..	..	..	..	£124-£131 per unit c.i.f.	
Zircon Sand (Australian) (63-66% ZrO <sub>2</sub> )	..	..	..	..	..	..	..	..	..	£20 per ton c.i.f.	

## LONDON STOCK EXCHANGE PRICES, DECEMBER 12, 1956

**Mining Finance**

## Increased Kaffir Dividends

Following last week's half-yearly declarations from the Anglo American Corporation's South African gold mines, payments from members of the Consolidated Gold Fields and General Mining groups have been announced. A good number of increases have taken place over June distributions, and it is most encouraging that only two mines—Sub Nigel and Vogelstruisbult—have had to make cuts, but as these reductions were expected their appearance did not cause undue disappointment.

Maiden dividends are to be paid by Eastern Rand Extensions and Southern Van Ryn Reef, both of which are in the General Mining group. These two companies have sizeable investments in the Lucas Block mines, amongst which Hartebeestfontein figures prominently. It will be recalled that Harties recently paid a maiden dividend itself, and this is no doubt the reason for distributions from the two holding companies.

As overall earnings at Luijpaards Vlei have recently followed a declining trend, a more liberal distribution from the mine had not been expected. Besides this, the chairman's recent warning regarding difficulties underground which are militating against maintaining mill throughput, makes a higher payment all the more difficult to understand. Yet, in the past, the company has tended to under-distribute and its liquid assets have in consequence become strong. It may be that the future is regarded in a sufficient optimistic light to prompt the use of these reserves for temporary dividend equalization.

Although a better mill grade at Robinson Deep has recently boosted profits, the higher payment from this mine was none the less well received. West Driefontein's increase was also the outcome of greater earnings over the past months, while a more generous distribution might also have been due to uranium production having now got under way.

Lower costs and higher earnings at

Vlakfontein made a higher payment possible. Development values at the property have recently shown useful rises, and should they continue, might at length exert a favourable influence on mill grade. Rising profits at West Rand Consolidated have been reflected in a more liberal payment.

### SETBACK FOR NEW UNION

When Lt.-Col. R. L. Broad, chairman of New Union Goldfields, expressed the hope in October, 1955, that his company was approaching the time at which the question of a dividend payment might be considered, no one expected the gradual but relentless decline which has since taken place in the market prices of gold shares. For a company striving to build up its financial resources this was indeed an unfortunate blow, resulting as it has in the necessity of having to draw upon reserves to the extent of some £342,600 in order to absorb an investment depreciation charge of £527,000. Yet, if nothing else, this necessity vindicated the prudence of past financial policies which have had as their primary objective the question of establishing strong reserves with which to face the future, rather than paying dividends.

Serious though the past financial year's experience has been, the future picture is not without its encouraging features. Foremost amongst these is the likelihood that the company will soon have to depend less for revenue upon volatile share-dealing profits, and will be able confidently to anticipate a dependable and expanding yearly income from the promising young mines in which so great a part of its interest lie.

Income from underwriting and other commissions showed an increase during the past year and included receipts arising from the flotation of Free State Saaiplaas Gold Mining, and a capital re-organization effected by Anglo-Rand Mining and Finance Corporation.

Just as the past financial year's fall in gold share prices has meant a severe setback for New Union, any future improvement in market sentiment could quickly reverse this position. Yet, as Col. Broad has pointed out, the company's liquidity is still very largely dependent upon a degree of sustained market activity. Sales from existing holdings, he pointed out, are normally looked to as a means of self-financing to provide at least a part of funds required for new investment.

Under adverse market conditions a lack of quick resources could obviously cause difficulty for a company in the mining finance business, and unless prices soon take a distinct turn for the better, some temporary embarrassment could arise. Nevertheless, with the majority of its interests in some of the most promising gold mines in South Africa, it would be hard to describe the outlook for the group as anything but favourable. The fall in the company's 5s. shares from a high point of 6s. 7d. this year to their present level of around 4s. 6d. may thus eventually prove to have been overdone.

### GOLDS DECLINE

Measured by *The Dow Jones Industrial Index* which fell from 492.74 on December 6 to 487.51 by December 12, Wall Street prices suffered a minor setback during the past week. Yet this was not the case in London and, unexpectedly, in view of the many adverse influences, *The Financial Times Industrial Ordinary Index* was able to move up to 175.5 from 168.5. This improvement was largely due to a shortage of stock, although some confidence seemed to be derived from additions to U.K. dollar reserves resulting from arrangements with the I.M.F. while high November export figures assisted sentiment. Sterling firmed up on these considerations.

At one time it seemed as if Kaffirs would attract a larger following amongst those who expected a devaluation of the pound, but initial gains quickly disappeared when a more confident tone developed in industrials and the Funds. *The Financial Times Gold Share Index* lost 2.4 points over the week to 76.8. Half-yearly dividends from the Gold Fields and General Mining groups were well received, especially in the case of Eastern Rand Extensions which were a strong market.

Coppers were neglected and small losses took place over the week but diamonds and platinums both held firm. Tins went lower in places on the falling metal price, while West African golds were adversely affected by Gold Coast politics. In the miscellaneous section, Trepca lost the turn following liquidation proposals, while Mawchi Mines shed a few pence on the latest report. Amongst Australian lead-zincs Consolidated Zinc moved up about a shilling, but New Broken Hill declined.

### DECEMBER KAFFIR DIVIDENDS

**Gold Fields**

	Dec. 1956	June 1956	Dec. 1955	June 1955
Libanon	3½	3½	3½	3
Luijpaards Vlei	10½	9	7½	7½
Rietfontein Con.	1 1	1 1	1 2	1 1
Robinson Deep	6	3	1 6*	1 6*
Simmer	5	5	5	4
Sub Nigel	2 4½	3 0	3 3	3 6
Venterspost	10½	9	7½	6
Vlakfontein	10	9	8	8
Vogels	1 6	1 8	1 8	1 7½
W. Driefontein	3 0	2 9	2 6	2 3
West Wit.	1 3	1 3	1 1½	1 1½

\* Including 3d. additional payment.

**General Mining**

S. Roodepoort	1 1½	1 1½	10½	10½
Stilfontein	6	6	6	6
W. Rand Con.	2 3	1 9	2 0	1 9
E. Rand Ext.	6	—	—	—
S. Van Ryn Reef	2	—	—	—



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## FINANCIAL NEWS AND RESULTS IN BRIEF

**Lonrho's Real Estate Sales.**—In pursuance of its policy of liquidating certain holdings of undeveloped real estate, London and Rhodesian Mining and Land Company sold a further 6,351 acres during its past financial year and realised a profit of approximately £5,000. This sum was credited to profit and loss account. In his statement to shareholders, Sir Joseph Ball stressed the fact that profits from these sales had now become available for investment in more remunerative directions. Twenty stands were still owned in towns in Southern Rhodesia, including two properties in the centre and one in the industrial area of Salisbury, and one in Main Street, Bulawayo.

During the year ended June 30, 1956, Lonrho made consolidated net profits of £50,066 compared with £60,578 previously. Dividends absorbed £57,500 (£55,663) and the balance carried forward moved up to £54,659 from £50,375. Investments shown at a balance sheet value of £844,205 had an estimated worth of £788,482 at June 30, 1956. Net current assets declined to £252,945 from £335,970.

**Mawchi Mines Loss.**—Subject to audit, estimated losses by The Mawchi Mines during the year ended March 31, 1956, amount to £25,000. This figure includes care and maintenance costs for nine months prior to resumption of mining and milling operations.

As stated in a progress report issued last May, mining and milling operations were not re-started until January, 1956. Mill production for the last three months of the financial year amounted to 23 tons of mixed concentrates, while tributary operations throughout the year brought in 130 tons, making a total production of 153 tons.

During the first six months of the current financial year a total of 5,210 tons of ore have been treated for a yield of 59.05 tons of mixed concentrates. Tributaries increased this figure by 20.25 tons raising the overall total to 79.30 tons of mixed concentrates for the period ended September 30, 1956. Owing to conditions at the mine, the grade of ore treated and mill recoveries were below normal.

As at June 30 last much of the mine was still inaccessible due to falls of ground in drives, cross cuts, adit portals, etc. No major re-opening operations were accomplished during 1955-56, efforts being directed towards re-opening sufficient veins to enable the resumption of mining operations on a small scale as soon as possible.

**Burma Corporation.**—Operations carried out by Burma Corporation (1951) which is owned jointly by Burma Mines and the government of Burma, during the year ended June 30, 1956, resulted in a higher estimated net profit, after taxation and depreciation, at £518,535 compared with only £323,538 previously. Sales of pre-war stocks of zinc concentrates again made a substantial contribution to these results. Full details of the company's production were given on page 674 of our November 30 issue. These revealed that ore extraction increased to 111,198 tons from 102,252 tons in 1955-55. Marketable products included 14,885 tons of refined lead (11,515 tons), 1,358,513 oz. of silver

(1,036,813 oz.) and 13,953 tons of zinc concentrates (13,021 tons).

Estimated operating profit—after adjustment for the value of metal stocks—for the June quarter of 1956 was £309,877 compared with £237,450 during the previous three months.

**Selection Trust Maintains Interim.**—With the declaration of an interim dividend of 17½ per cent Selection Trust has maintained its interim dividend on the issued ordinary capital of £2,472,244 in 10s. stock units as increased by a five per cent scrip issue last May. During the previous year the same interim rate was paid on the smaller capital of £2,354,518, and was followed by a final of 42½ per cent making 60 per cent for the year.

**Trepca to Liquidate.**—At the meeting of Trepca Mines Mr. A. Chester Beatty, the chairman, stated that an extraordinary meeting would be convened as soon as practicable in order to place the company in voluntary liquidation. If the proposals were approved, it should be possible for the liquidator to make cash distributions totalling at least 5s. per stock unit and 3s. 6d. could be paid in the early part of 1957. Mr. Beatty pointed out that the liquidation could not be completed until the remainder of compensation money had been received by the company. This might not be until early in 1958.

**Zam's Interim.**—The Zambesia Exploring Company has raised its interim dividend to 6 per cent on an issued capital of £954,028. While this compares with 4 per cent for the previous year paid on a capital of £908,599 prior to the 1 for 20 rights issue, the increased payment should not be taken as indicating a higher distribution for the year ending March 31, 1957. This was followed by a final of 13½ per cent making a total of 17½ per cent for the year.

**Fresnillo Pays 70 c.**—The Fresnillo Company has declared a dividend of 70 c. (or 59½ c. net after deduction of 15 per cent Mexican dividend tax). This compares with 60 c. in respect of the previous year.

At the company's annual meeting held on November 27 the board of directors was re-elected by a vote of approximately 73 per cent of the outstanding stock. There were no votes in opposition.

**Berjuntai Merger.**—In order to make the fullest use of combined equipment and cash resources, and in particular to develop a large property adjacent to its mining leases, the Berjuntai Tin Dredging Company plans to acquire Rawang Tin Fields and Rawang Concessions. This will be effected by an exchange of shares and cash payments.

**Gopeng and Pengkalan Repayments.**—Proposals for capital repayments by Gopeng Consolidated and Pengkalan have received overwhelming support from shareholders. In the case of Gopeng the repayment amounted to 1s. 6d. per 5s. unit, and for Pengkalan 4s. per 5s. unit. Immediate steps are to be taken to obtain Court approval for the transaction; and distributions will be made as soon as possible.

Both companies have stated that negotiations between them and other companies of the Osborne and Chappell Group, on the one hand, and the Tronoh-Malayan group on the other, with a view to closer association both in the U.K. and in Malaya, are now in progress.

**Informal Meetings of Kolar Companies.**—John Taylor and Sons have invited members of The Mysore Gold Mining Company (in liquidation), the Champion Reef Gold Mines of India, and Nundydroog Mines to an informal meeting at Winchester House, Old Broad Street, London, E.C.2, on December 18, at 2.30 p.m. The purpose of this meeting is to enable members who live in the U.K. and have not, therefore, been able to attend meetings held recently in India, to receive a report on the effects of recent nationalization.

**SHIFT BOSS required for U.K. lead/zinc gravity and flotation plant.** Send particulars to Box No. 585, c/o Charles Barker and Sons Ltd., Gateway House, London, E.C.4.

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## ANGLO-TRANSVAAL CONSOLIDATED INVESTMENT COMPANY LIMITED

### GROUP'S CONTINUED PROGRESS

### APPEAL TO LOCAL INVESTORS

The Twenty-Third Annual General Meeting of the Anglo-Transvaal Consolidated Investment Company Limited, was held on December 7 in Johannesburg.

**Mr. S. G. Menell**, the Chairman of the Company, presided and, in the course of his address, said:—

The Profit and Loss Account reflects net revenue for the year of £1,041,600 and a net profit of £920,600. The provision for taxation amounted to £144,000 and an amount of £225,000 was written off investments leaving a balance transferred to the Appropriation Account of £551,600, which with £379,100 brought in at the beginning of the year made a total of £930,700 available for appropriation.

Dividends on the various classes of our Share Capital absorbed £516,300. The amount carried forward on the Appropriation Account at credit is £385,800.

The total book value of investments in subsidiary companies and other concerns amounts to £6.8 million, compared with £5.7 million, for the previous year—an increase of £1.1 million due chiefly to the exercise of rights to take up shares in new gold mining companies. The market value of shares and interests in concerns other than subsidiary companies was £4.8 million against a book value of £4.5 million, and the quoted investments in subsidiary companies had a market value of £2.1 million compared with the book figure of £1.7 million.

There was thus a surplus of £740,000 of market over book values, not taking into account the specific provision of £600,000.

In the opinion of your Directors, the unquoted investments in subsidiary and other concerns are conservatively valued.

The Reserve Fund of £3,500,000, together with the unappropriated profits of £385,800, totals £3,886,000, which is over £1,000,000 in excess of the issued capital.

The accumulated revenue reserves of the subsidiary companies in the Group of which Anglo-Transvaal Industries Ltd. is the principal subsidiary, aggregate £1,753,000. Of this amount your Company's proportion is approximately £1,000,000. The main industrial interests of Anglo-Transvaal Industries Limited have shown a gratifying record of continued expansion.

The Chairman then reviewed the Company's principal interests, covering gold, base metals, coal and industrial undertakings, and continued:

#### Source of Capital Requirements

The recent launching of the Riebeeck Gold Mine in spite of the present disturbed state of the financial market, is yet another example of the faith that the Rand Mining Houses have in the long-term prospects of their mining ventures. In this instance the underwriters, who are the Anglo-American Corporation, General Mining and Finance Corporation and our Group, proceeded on the basis that the development of the country's Mining Industry is of paramount importance and should not wait on a revival in share market activity.

This brings me to a problem which has been referred to frequently in recent years and the solution of which is still the key to the rate of our economic development in this country. I refer to the capital famine.

While savings in this country have increased enormously, and while the degree of re-investment of profits on the part of industrial and commercial undertakings has also increased, if we are to maintain even a reasonable momentum of progress such internal capital formation must be supplemented for many years by capital inflow from overseas.

Now, for a variety of reasons, capital is not coming into this country in the volume which is desirable.

As a country we can but continue to do all in our power to attract capital from overseas. But we must face up to the hard, sober fact that it is unlikely that the volume of the free flow of capital to which we have become accustomed in the past will be available in the future. We will have to depend more on our own resources. It is unfortunate that at a time when we are forced to depend upon our own resources there should be such a marked apathy on the part of South African investors to invest in South African equities.

With our country's rapidly expanding economy and increased purchasing power the savings potentiality of our population is continually growing.

It is a matter of national importance to channel a portion of these available funds into mining and industrial equities and every effort should be made to bring this home to the average citizen.

As long as private enterprise is accepted as playing a necessary and important part in the country's advancement and prosperity the withholding of capital for this purpose would be a disservice to the country as a whole.

All around us there are great projects which have been brought to fruition by private enterprise in this country and brought it wealth and prosperity, and in this we see tangible signs of risks well taken. In all aspects of our economy, risks have been taken by the public at large, and the public at large have benefited from the results.

The restoration of a commensurate proportion of private savings for the acquisition of equities will in the aggregate, re-establish the pattern of finance which in the past had started and maintained the turning of the wheels of mining, industry, and commerce, in which pattern the Stock Exchange has played an invaluable part in mobilising the supply of capital needs for the country's economic expansion.

The Report and Accounts were adopted.

## HARRISONS & CROSFIELD, LTD.

### LARGER PROFIT AND DIVIDEND

The forty-eighth annual general meeting of Harrisons and Crosfield Ltd. was held on December 10 in London.

**Sir Eric Miller**, the chairman, presided and in the course of his speech, said:—It is gratifying that the good start which I was able to report to you 12 months ago was sustained to the end of the period. The gross profit for the year to June 30, 1956, before depreciation, taxation, etc., amounted to £1,884,000, an increase of £240,000 on the previous year.

Nearly all the increase in the gross profit is absorbed by taxation, so that, after deducting this and all charges, the net profit is only £18,000 up at £601,000. The final dividend of 10%, will make 15% for the year on £1,500,000 Deferred Ordinary Stock, against the previous year's total of 20% on the then issued Stock of £1,000,000, equivalent to 13½% on the present stock.

#### Tea

Prices in world tea markets during 1956 have not registered such wide fluctuations as they did in the previous two years, but a notable feature has been the very high level to which competitive demand raised prices for the limited quantities of fine tea available.

The price concertina has closed and there is now a much smaller margin between the prices realised by this class of tea and the better liquorising Assams. There are now keen buyers of the lower qualities which have risen by no less than 1/7 per lb. within the last month.

Such violent price movements are most disconcerting to all concerned in production and distribution. There is plenty of tea to come forward and an

easier price situation may be expected to develop in the New Year.

World production may be only 10 million lb. less than in 1955. Even so, it is running ahead of normal absorption. The future for producers of plain teas is dependent on the wholesome habit of tea-drinking being more encouraged.

#### Rubber

A year ago the price of No. 1 RSS was at the inflated level of 40d. per lb. I did not, however, foresee that by the end of May the price would be down to 22d. per lb. More recent events leading up to the blocking of the Canal have brought the spot price for No. 1 RSS up to around 32½d. in London.

World consumption of Natural and Synthetic Rubber during 1956 is running at a rate of around 3,000,000 tons per annum. In the U.S.A. the proportion of Natural used seems to be stabilising around 38 to 39 p.c. So long as Natural is available in ample quantities European manufacturers outside the Iron Curtain are using Synthetic on only a moderate scale.

All the indications are that there will be a fairly close balance between production and consumption of Natural Rubber in 1956. As any substantial increase in the production of Natural can at best be gradual and as the world must not find itself short of rubber, some increase in synthetic producing capacity is a wise precaution. These violent fluctuations are most disconcerting to the industry. Expansion in the use of motor transport in practically every country in the world is a certainty.

The report and accounts were adopted.



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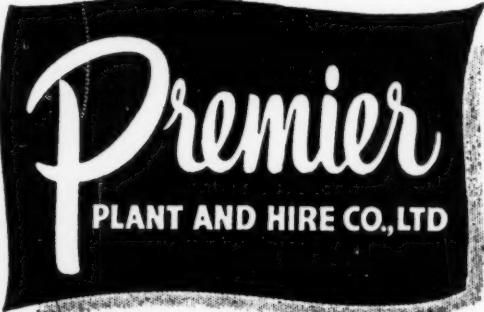
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